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Review of patients discharged post thoracic surgery with chest drain *in situ* and nurse-based follow-up clinic

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Ethical Statement: This study was conducted as a retrospective audit. It was approved by the quality and audit department at Royal Victoria Hospital, Belfast on 16th February 2021 with the reference number 6347.

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Competing interests: None

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Abstract

Persistent air leak and prolonged drainage are recognized complications of thoracic surgery, increasing hospital stay and costs. Patients can be discharged with a chest drain and followed up in a nurse-led clinic. We reviewed such patients and the rate of readmission after discharge to assess the effectiveness of the drain follow up clinic. Retrospective review of our prospective database for 22 months (March 2019 to January 2021). Analysis focussed on indication and duration of chest drainage, complications, and readmission for any reason. 62 patients (representing 5% of all thoracic surgery patients) were discharged with a chest drain. Median age was 67 years (range 22-85 years), 24 females and 38 males. 52% underwent video-assisted thoracoscopic surgery, 27% had a thoracotomy, and 21% had bedside chest drain insertion. Following discharge, median duration of chest drainage was 11 days [interquartile range (IQR) 7-18.75 days]. Patients had 106 review episodes in the ward-based nurse-led clinic. Indication was prolonged air leak (71 %; 72 clinic reviews), persistent fluid drainage following empyema evacuation (16%; 24 clinic reviews) and persistent fluid drainage for simple effusion (13%; 10

clinic reviews). Median length of drain stay was 30 days (IQR 19.75-54 days) for empyema, 10 days (IQR 6-16 days) for air leak and 8 days (IQR 6.5-12 days) days for simple effusion. 9 patients required readmission (14.5%) and empyema had developed in 3 patients (4.8%). Patients discharged with a chest drain in place can be followed up in a dedicated ward-based nurse-led monitoring clinic for optimal quality of care.

Keywords: Chest drain; outpatient; nurse-led; thoracic surgery; empyema; air leak; hospital stay; quality of care.

Introduction

The placement of a chest drain connected to an underwater seal or digital drainage system represents a standard step at the end of almost every pulmonary or pleural intervention; it is considered an essential part of post-operative treatment in thoracic surgery [1-4]. The aim of the drain is to achieve adequate drainage of fluid or air from the pleural cavity. When all air leaks are completely resolved post operatively, and there is no further significant fluid drainage output (usually less than 200 mL/24 hours), the drains can be removed. However, these criteria may not be met in the immediate post-operative period and on many occasions the drain is required for longer. In these cases, persistent air leak or drainage requiring a chest drain may be the only indication for continued hospitalization. Persistent drainage and air leaks are recognized complications of either elective or acute thoracic surgery. Conservative management by prolonged chest drainage dramatically increases length of stay and burdens on the cost of care by impacting on both inpatient stay and outpatient resources [1,2].

To reduce the cost of the hospital stay while maintaining high standards of care and patient satisfaction it has been demonstrated that patients can be discharged safely home with portable chest drainage systems [1]. Usually, such patients are reviewed in a standard outpatient clinic but an alternative is a ward-based, nurse-led clinic. These sorts of monitoring services have proved to be safe and cost efficient [1,5]. Also, ambulatory chest drain systems can increase mobility and independence in those patients with prolonged air leaks or fluid drainage [1].

The aim of this study is to review outcomes of patients discharged with drains *in situ* and to review the centre's experience of the quality of care of such patients in a nurse-led drain clinic.

Methods

We performed a retrospective analysis of the database and activity of the chest drain clinic over a period of 22 months. This included patients who had surgery and were discharged with a

drain in situ between 8th March 2019 and 6th January 2021. The required data was obtained from the database registry that was populated by the thoracic nurse specialist using a specifically designed template at the time of review. The extracted data included demographic and clinical items such as age, sex, type of procedure, approach, number of chest drains on discharge and their follow up details. Afterwards an analysis was performed on the gathered information, looking at number of patients discharged with a drain in place, the indications for discharging with a chest tube, the duration the chest tube has remained and the related complications. This audit was registered with the trust in accordance with research governance guidance and further ethical approval was deemed not to be required.

Results

Over the study period, 62 patients were discharged with a drain in situ. This represents 5% of all patients who had thoracic surgery during the study period. They were all reviewed in the nurse-led drain management clinic. The median age of patients was 67, with a range from 22 to 85 years (mean age was 61±16 years). Overall, there were 106 review episodes for drains by our Thoracic Nurse Specialist (TNS). 39% (24) of patients were females and 61% (38) were males. The types of surgical procedures performed in the reviewed patients are summarised in Figure 1. The majority of patients had VATS approach (52%). 21% of patients had isolated insertion of chest drains at the bedside. Adopted approaches are summarised in Figure 2. As can be seen in Figure 3, it was most common that patients only required a single review appointment after which they could be discharged from the nurse-led clinic (51.6% of cases). In some cases, further appointments were required as the drain could not be safely removed at the initial meeting. The minority of patients (17.8%) required 3 or more reviews, and of that only 2 patients required in excess of 3 reviews (Figure 3). In the majority of cases the patient was discharged with a single drain in situ so that when it could be safely removed the patient did not need a further review in this clinic. Only 6.5% of patients were discharged with 2 drains *in situ*. Whilst the requirement of a review, and in some cases multiple reviews, comes with a cost it is important to consider the length of stay that would have been necessary based on the length of time the drain was in situ. The median length of time chest drains were left *in situ* for these patients was 11 days [IQR,7-18.75 days] as summarised in Figure 4. The predominant cause of a prolonged chest drain regimen was a persistent air leak (71%). The other indications were non-infected simple effusion, with a persistent drain output of >200mL in 24 hrs, and prolonged drainage following evacuation of empyema (Figure 5).

The longest duration that chest drains were left in situ in the study group came from those with empyema (average stay of 39 days, median 30 days (IQR,19.75-54 days) and the shortest duration was for those drains inserted for effusion. These results can be seen summarised in Figure 6. Patients with persistent air leak accounted for 68% of reviews. Overall, 23% (24/106) of reviews were for empyema. The contribution of each aetiology on the clinic can be seen in Figure 6. Once discharged, these patients were reviewed after a median of 9 days (IQR, 6-15 days). During the study time nine patient's (14.5%) had to be readmitted for various reasons (Table 1). The rate of empyema on follow up was 4.8%, two patients required readmission for antibiotic treatment and one required decortication. The remaining 85.5% were successfully managed in the community without requiring readmission. For those readmitted the average time to readmission was 14 days and mean length of the second admission was 5.37 days. In most cases (78%) the patient was discharged with a drain still *in situ*.

Discussion

Chest tube management is arguably one of the most significant factors that affects the length of hospital stay in thoracic patients, adding a significant strain to the healthcare expenditure. The management of chest drains in a flexible out-patient setting aims to be cost effective by reducing the length of hospital stay after thoracic surgery. Furthermore, patients from across the region who are discharged home with a chest drain in place, have access to expert support and advice while the drain is in situ.

The authorities in the UK have been endorsing the Nurse-led clinics since the early 1990's [1]. In thoracic surgery, a dedicated nurse-led clinic for patients who are discharged with a chest drain in situ started as early as 2007 in some areas [1]. At the Royal Victoria Hospital, Belfast such clinic was started in April 2017 on an ad hoc basis initially, having been established by a well-trained thoracic nurse specialist (TNS). It has been run on weekly basis since then, taking place over the course of the whole working day for 2 days a week divided into 90 min appointments for individual patient review.

Initially, the Consultant/Specialist Registrar on the thoracic ward will decide which patients are suitable for discharge home with ambulatory chest drains. Communication between the surgical team enables the TNS to review the patient on the thoracic ward prior to discharge and arrange review at this clinic within 7-14 days. Patients are provided with the details of the appointment prior to discharge from the thoracic ward. Contact details of the TNS and thoracic ward are provided to the patient to re-arrange the appointment if necessary, thus allowing flexibility for patients and helping to improve the overall efficiency of the service. The patient

is given an X-ray form on discharge and advised to have a chest x-ray before attending the clinic. The patient is trained on the management of the ambulatory drain device and they are provided with an appropriate information booklet. A district nurse will be organised to assess the patient at home upon discharge. The TNS aims to carry out a follow-up call within 48 hours of discharge from the ward. The clinic takes place in a designated assessment room within the thoracic ward. As such, emergency medical cover is available and ward nursing staff can provide assistance if necessary. Emergency equipment to enable chest drain reinsertion is available within the ward if required.

On attendance at the clinic the patient's drain is assessed for the amount of drainage any signs of air leak. The patient will have a chest X-ray, and this will be reviewed by the Thoracic Specialist registrar or Thoracic consultant. Additional tests can be carried out if deemed necessary.

If the drain is to remain, suitable arrangements are made to review the patient, either at an outpatient clinic or on the ward. The clinic review is recorded onto the patient's file. The TNS records the outcome of the clinic using a template and uploads this directly onto the patient's electronic record. The TNS does all the administration for the clinic, thus there is no extra administration cost. Additionally, while the regular outpatient reviews are carried out in a dedicated outpatient clinic, the nurse-led service can be offered with fewer staff numbers in a ward setting, thus acquiring much lower logistical costs. Also, by making use of the wards fully equipped store rooms that are available 24/7, there are no extra fixed expenses. Hence, cost of this drain clinic service is lower by comparison.

Chest drain insertion can become prolonged in various instances and this study has suggested that the most common is a persistent air leak, consistent with other studies [1-3], with effusions and empyema being other recognised causes. These patients would require prolonged hospital admission which comes with high costs and physical/psychosocial implications for the patient. In the current era of VATS procedures, with an increasing interest in shorter hospital length of stay we aim to discharge patients as early as possible as supported by the enhanced recovery after surgery (ERAS) protocol [6].

Moreover, the current COVID-19 pandemic has had profound effect on bed availability and the risk of nosocomial infection makes a shorter hospital admission even more desirable. This has increased the number of patients discharged with a drain in situ and the nurse-led drain clinic was very supportive and efficient in tackling the medical issues, keeping patient's care optimised. The reduction of usual consultant led outpatient clinics, due to the COVID-19

pandemic, has resulted in an increase in the number of patients attending the drain management clinic.

In the study period of 22 months 62 patients had 106 review episodes in the clinic. The majority were reviews for persistent air leak, with empyema and effusions being other causes. All of these contributed to prolong hospital stay. It is clear that reducing these stays will increase the capacity for further admissions and operations to help reduce the waiting lists which is becoming increasingly more important since the COVID pandemic. A nurse led clinic that facilitates discharge with a drain in situ seems to offer a viable means to achieve this and the majority of patients only require a single review by a TNS prior to drain removal. From this study it appears clear that this practice is safe with only a small minority of patients requiring readmission to hospital which generally proved inconsequential in the long term.

It appears from this study and other evidence, that an organized service, dedicated to outpatient chest tube management, can facilitate early discharge without any additional complications. Furthermore, it can function without constant medical supervision if strict protocols are adequately implemented following adequate staff training. Such a clinic has run in the thoracic surgery department at the Royal Victoria Hospital, Belfast since 2017 and has received a very high patient satisfaction as evidenced by an internal audit. The results of this study show that it has not led to any additional complications but offers a more cost effective alternative to prolonged hospital stay.

Whilst the results of this study are very positive, it is necessary to consider limitations of this service. It is important that these services are seen as adjunct to regular outpatient clinics whereby a consultant is immediately on hand to review the patient face to face if required. In addition, on occasion the nurse-led clinic requires support from surgeons for more complex cases and, in the absence of an assigned surgeon, as is the case in standard outpatient clinics, these cases are usually referred to the on-call registrar. In times of pressure, it can take time for an appropriately qualified surgeon to see the patient and address such issues. These delays can cause inconvenience for both the patient and TNS.

Study limitations

Limitations from this study include the single institution, retrospective nature, and large heterogeneity in the patient population as well as diversity in the surgeon's preference for the management of air leaks or effusion. Given the retrospective nature of this study, there is a limitation of knowledge on how patients would do if they were hospitalized with chest tubes

until their air leak resolved. Although the proposed sample size for this study should be adequate, a larger sample within multiple settings may yield more beneficial data.

Conclusions

Patients discharged with chest drain in place can be followed up by a dedicated ward-based nurse led monitoring clinic. A dedicated chest drain clinic staffed by specialist nurses helps to conserve resource by shortening hospital admission but also aids patient recovery. This study shows that the burden of persistent air leak is significant and the majority of these patients only require a single review in order to prevent a long hospital stay.

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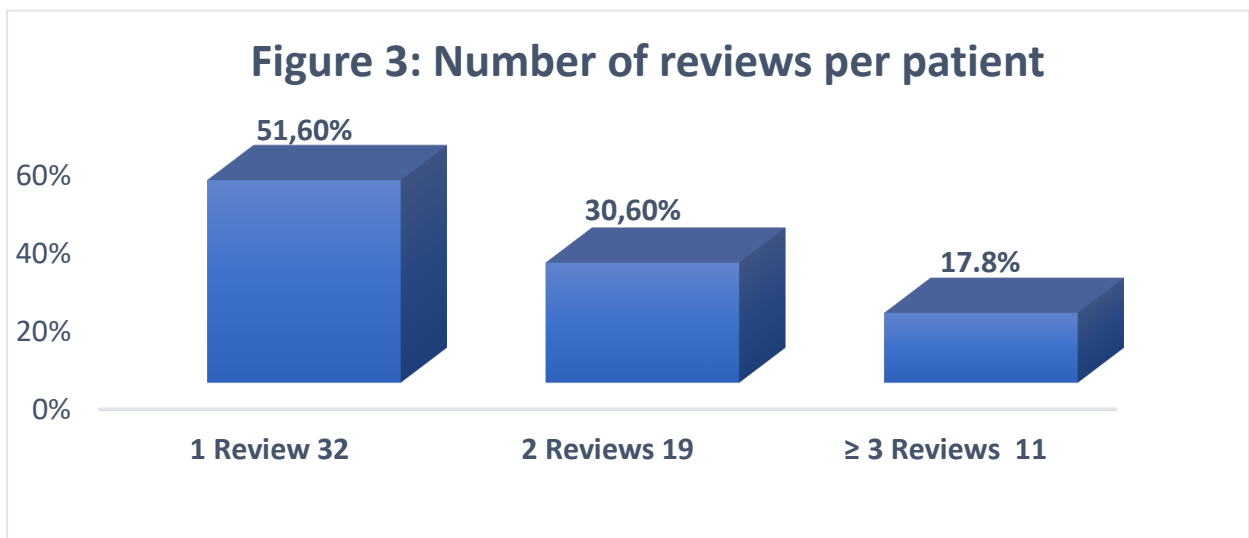
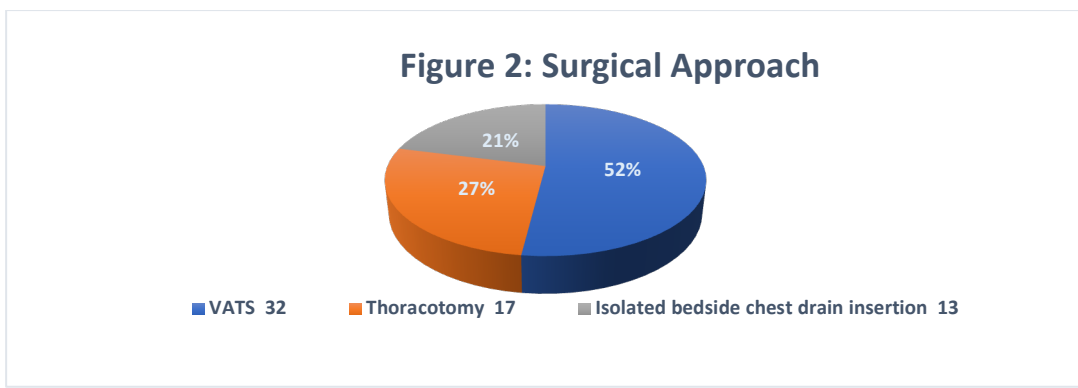
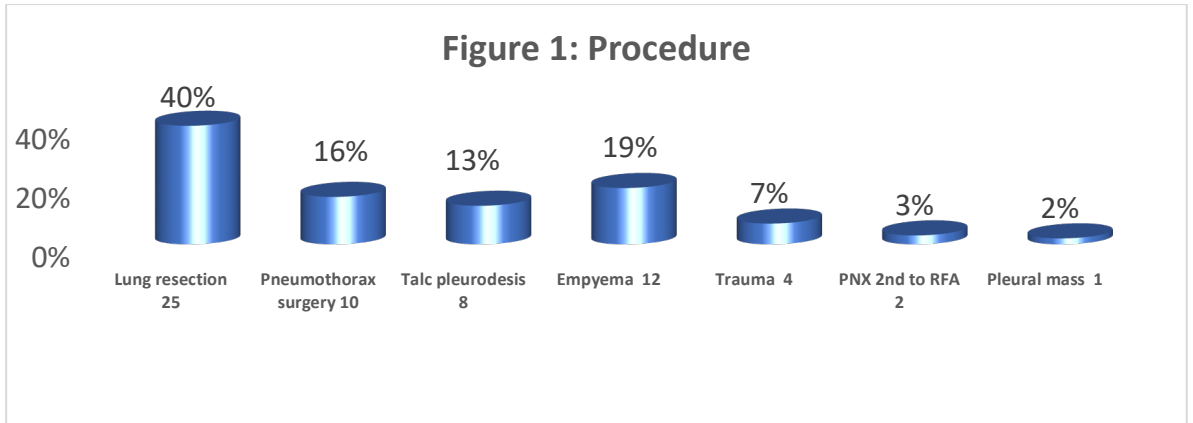


Figure 4: Duration of chest drainage

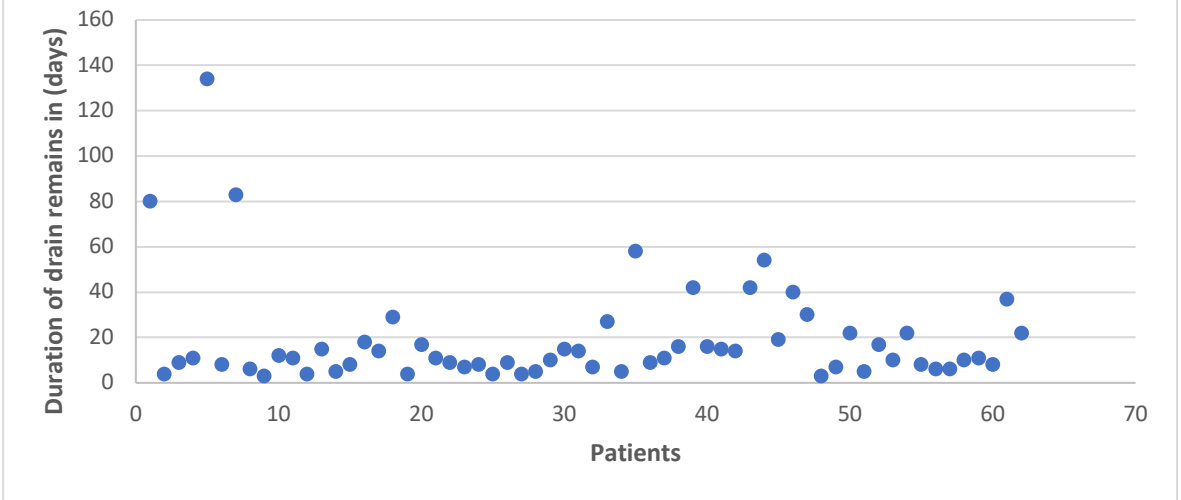


FIGURE 5: REASONS OF DISCHARGE WITH DRAIN

■ Air leak 44 ■ Effusion 8 ■ Empyema 10

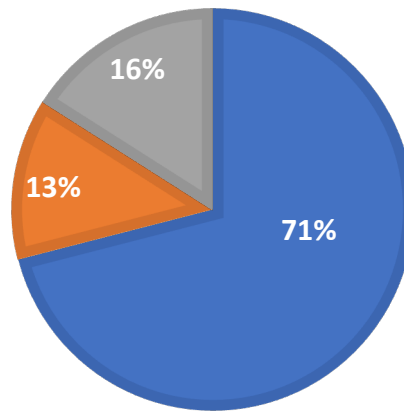
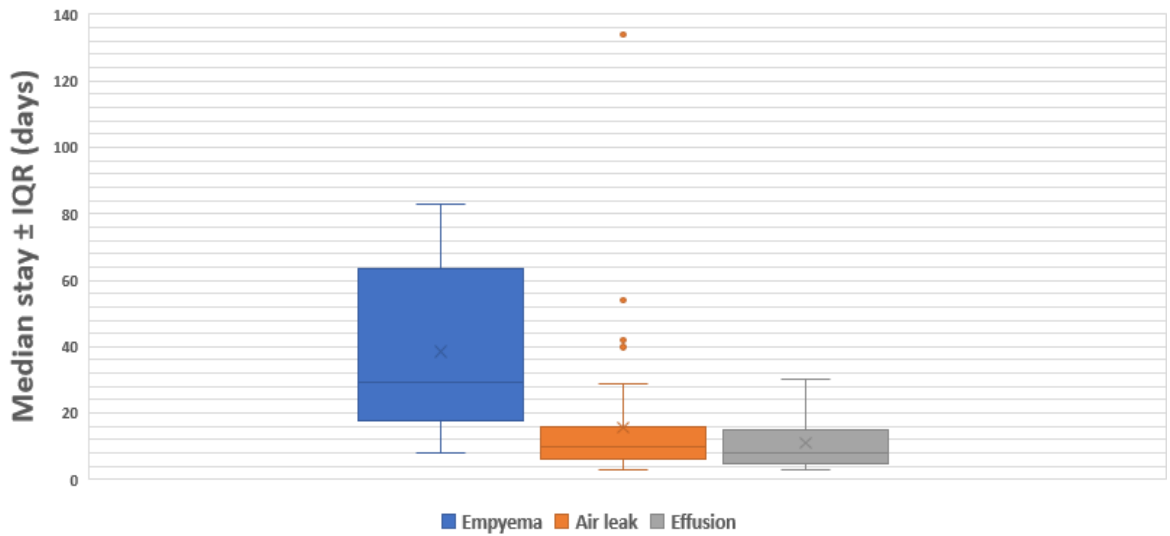


Figure 6
Drain's Length of stay per aetiology



Clinic reviews per aetiology	Empyema	Air leak	Effusion
No. of clinic reviews(%)	24(23%)	72(68%)	10(9%)

Table 1. Readmission during follow up		CAUSES OF READMISSION	
Reason for readmission	Number of patients (n=9)		
Chest infection	1		
Empyema	3		
Drain re-insertion	3		
Evacuation of Haemothorax	1		
Talc pleurodesis	1		