MANAGEMENT OF SECONDARY SPONTANEOUS PNEUMOTHORAX

CASE STUDY

Team:
Dr M. Purcell, Dr K. Steele, Western Sussex Hospitals NHS Trust (WSHNT)

Project title

Should large-bore (≥18 Fr) wire-guided chest drains be considered as standard management in cases of secondary spontaneous pneumothorax? A 3-year review of outcomes at a District General Hospital.

Location

Worthing Hospital. Worthing is a District General Hospital on the South coast providing a full range of general acute hospital services and is currently undergoing a merger to form University Hospitals Sussex NHS Foundation Trust. The respiratory team at Worthing provides inpatient and outpatient respiratory care including a weekly pleural service, sleep/ventilation service and cardio-pulmonary exercise testing.

Background

Secondary spontaneous pneumothorax (SSP) differs from primary spontaneous pneumothorax (PSP) due to variability in baseline patient co-morbidities, higher risk of recurrence and longer inpatient stays. SSP patients require longer duration of drainage, sometimes resulting in complications or drainage failure. The practice of managing SSP with surgical drains (20-28 Fr) has declined. Originally, this was mainly due to patient discomfort, and now also due to the de-skilling of trainee doctors.

A recent meta-analysis indicated that pigtail catheter drainage was as effective as large bore drainage for pneumothorax and small-bore drainage (8-14 Fr) is now commonplace. [1] Current BTS guidelines recommend a 6-14 Fr drain placement for management of pneumothorax, however, efficacy in the SSP cohort requires further evidence base. [2]

A series of challenging secondary spontaneous pneumothorax (SSP) cases in 2013 prompted a local review of complication rates in those managed with chest tube drainage. This review process has been continued over three 1-year periods between 2013 and 2019.

Objective

The aim was to retrospectively determine if smaller bore drains (12 Fr) carried an increased risk of complications such as blockage or drainage failure in treatment of pneumothorax.

Medical records of patients treated for pneumothorax over three 1-year periods were retrospectively examined and data related to their management, complications and outcomes was extracted. The main focus was specifically on drain size, insertion technique and type of pneumothorax. Outcomes were recorded for each drain type and size to determine risk of complications.

Outcome measures

A drain was determined to have failed if it fell out, blocked, required replacement, required an additional drain or failed to resolve the pneumothorax. Failure events were recorded along with subsequent management.

Percentage failure rates were calculated for different drainage techniques with focus on 12Fr Seldinger and 18Fr Seldinger drains. These outcome measures were recorded for both primary and secondary pneumothoraces to provide a comparison of management strategies.

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Balance measures: 'Are the changes we are making to one part of the system causing problems in other parts of the system?

There has been a wholesale move in most trusts to use small bore 12Fr Seldinger chest drains for most pleural drainage. This has altered the skill set, with many practitioners having little or no experience at inserting trocar drains and with some departments not keeping stock of larger bore Seldinger drains.

Process measures: 'Are we doing the right things to achieve our goals?

The overall goal of this work was to identify if there are safety concerns related to pneumothorax management. It is hoped that this study will lead to larger cohort studies within the region, which may provide more definitive guidance on the optimum drain size for pneumothorax management. Optimising management guidelines will enhance patient safety and may lead to reduced length of stay and hence cost to the NHS.

Findings

Data obtained for management of PSP and SSP with 12 Fr and 18 Fr drains over the three review periods is presented below. Low numbers of drains were recorded for PSP with many cases being managed conservatively or with aspiration alone, especially in 2018-2019.

In 2013, the rate of complications following drainage of SSP with 12 Fr and 18 Fr drains was comparable, 57% and 50% respectively, with both demonstrating a high frequency of failure and often requiring further drainage.

However, there were 3 cases in particular of 12 Fr drains becoming blocked with one case resulting in a tension pneumothorax. These cases led the respiratory team to complete the initial 2013 audit of clinical practice and resulted in a recommendation that an 18 Fr drain be standard management for SSP at Worthing Hospital.

In subsequent years, improved outcomes were demonstrated with 18 Fr drains, while 12 Fr drains continue to be associated with a higher frequency of complications in SSP. In 2016-2017, while 1 drain failure was recorded for both 12Fr and 18Fr drains in the PSP group, 4 failures were recorded for those treated with a 12Fr drain in the SSP group.

These patients often required repeated chest tube placement. The results from 2018-2019 correlated with previous years, 50% of the 12Fr drains inserted for SSP encountered problems.
These included, requiring a second drain due to a large leak and sudden development of surgical emphysema. Conversely, those patients initially treated with 18Fr drains had a much lower rate of drain failure.
Please see Table 1 and 2 for tabulated data. In all three review periods, at least 50% of 12 Fr drains resulted in failure to successfully manage SSP.

Learnings to take forward

Despite small numbers, the results illustrate a high complication rate associated with 12 Fr chest tube drainage used in SSP at a DGH over consecutive years. The results suggest that larger bore wire-guided chest drains (18 Fr) should potentially be considered when managing SSP. These results should be approached with caution as this is a retrospective analysis with low numbers and possible confounding factors at play, such as unknown operator experience, location of chest drain insertion and location of patient care after drain insertion to name but a few.

Following this study, we have moved to insert 18 Fr as standard for SSP and therefore the numbers of patients having 12 Fr in this setting has fallen, making small numbers even smaller, but overall drain replacement rates have fallen.

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Table 1: Failure rates of chest tube drainage in Primary Spontaneous Pneumothorax

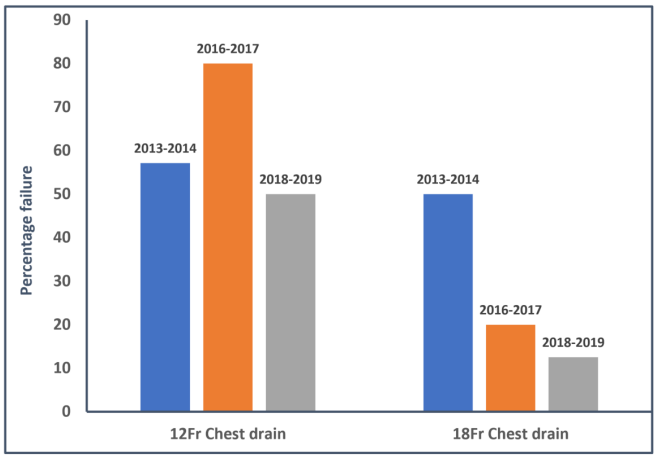
Year	12Fr Drains	Failures	% Failure	Failure Reason	18Fr Drains	Failures	% Failure	Failure Reason
2013-2014	4	1	25%	Pneumothorax reoccurred	0	0		
2016-2017	4	1	25%	failure to re-expand	2	1	50%	blocked - required replacement
2018-2019	0	0			0	0		

Table 2: Failure rates of chest tube drainage in Secondary Spontaneous Pneumothorax

Year	12Fr Drains	Failures	% Failure	Failure Reason	18Fr Drains	Failures	% Failure	Failure Reason
2013-2014	7	4	57%	3 blockages, 1 failed to re-expand.	4	2	50%	2 blockages requiring replacement
2016-2017	5	4	80%	2 blocked, 1 misplaced, 1 fell out	5	1	20%	1 required surgical drain due to blockage
2018-2019	10	5	50%	3 required further drains due to large leak, 2 required replacement	8	1	12.5%	1 required a larger drain

The nature of pneumothorax as a clinical presentation means that a respiratory specialist may not always be present when initial treatment is administered, and this may have an impact on outcomes. More detailed work with larger patient numbers is required to determine if this is a reproducible phenomenon experienced by other centres. We hope that this small study will stimulate prospective cohort studies within the region in future.

Figure 1: Graph indicating failure rates of 12 Fr versus 18 Fr chest tube drains in management of SSP over the 3 review periods.



References

1. Chang SH, Kang YN, Chiu HY, Chiu YH. A Systematic Review and Meta-Analysis Comparing Pigtail Catheter and Chest Tube as the Initial Treatment for Pneumothorax. Chest 2018;153(5):1201-1212.
2. McDuff A et al. Management of spontaneous pneumothorax: BTS pleural disease guideline 2010 Thorax 2010;65(Suppl 2):ii18-ii31

Contact

Dr Martha Purcell
ST4 Respiratory Registrar, KSS deanery
Martha.purcell@nhs.net

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