Chest drain fall-out rate according to suturing practices - a retrospective direct comparison

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Short title: Is suturing a chest drain necessary?

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Funding: There is no specific funding to declare for this study, however M Hassan is recipient of a long-term research fellowship from the European Respiratory Society – ERS LTRF 2016-7333; RJ Hallifax is funded by a clinical training fellowship from the medical research council (MR/L017091/1; NM Rahman is funded by the NIHR Oxford Biomedical Research Centre.

Keywords: Pleura, pleural catheter, pleural effusion

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Abstract

Background: Chest drains often become displaced and require replacement, adding unnecessary risks to patients. Simple measures such as suturing of the drain may reduce fall out rates, however, there is no direct data to demonstrate this and no standardised recommended practice that is evidence based.

Objectives: To analyse the rate of chest drain fall out according to suturing practice.

Methods: Retrospective analysis of all chest drain insertions (radiology and pleural teams) in 2015-2016. Details of chest drain fall out were collected from patient electronic records. Drain "fall out" was pre-hoc defined as the drain tip becoming dislodged outside the pleural cavity unintentionally before a clinical decision was taken to remove the drain.

Results: 369 chest drains were inserted: sutured (n=106, 28.7%; 44 male (41.5%), median age 74 (IQR 21) years), and unsutured (n= 263, 71.3%; 139 male (52.9%), median age 68 (IQR 21) years. Of the sutured drains, 7 (6.6%) fell out after a mean 3.3 days (SD 2.6), compared to 39 (14.8%) (p=0.04) unsutured drains falling out after a mean of 2.7 days (SD 2.0) (p=0.8).

Conclusions: Within the limits of this retrospective analysis, these results suggest that suturing of drains is associated with lower fall out rates.

Introduction

Chest drains often fall out and require replacement, adding unnecessary patient risk and discomfort, prolonging hospital length of stay, and increasing workload on respiratory and radiology departments. In cases of malignant effusion, where drains are not re-inserted after falling out, pleurodesis may need to be deferred until fluid re-accumulation, delaying definitive treatment. Reported fall out rates are variable, and the 2010 British Thoracic Society pleural disease guidelines [1] suggested auditing chest drain fall out rates. In the British Thoracic Society national pleural procedure audit 2015,[2] 9.2% of chest drains fell out, and in the randomised controlled TIME1 trial where all drains were sutured, 42% of 12F drains and 28% of 24F drains were unintentionally displaced.[3] Simple measures such as suturing may reduce fall out rates; although in many centres, suturing of chest drains is common practice, there is no direct data to demonstrate efficacy, and drains are still placed by a wide range of specialists, in whose practice stitches are not universally used. Reasons for not suturing drains include time-saving, lack of suturing skills, the perception that drain-dressings are adequate and that chest drains do not fall out when they are unsutured. This perception may be especially common in operators who are not responsible for the follow-up care of patients beyond the chest drain insertion procedure. In contrast, among operators familiar with suturing, the perception is that suturing is easy and does not add significant procedure-time and serves as a further anchor beyond the usual drain dressings.

Aim

In our Trust, chest drains inserted by the pleural team are sutured in place as standard practice, while chest drains inserted by other teams (including radiology) are variably sutured. The aim of this

study was to assess chest drain fall out rates, and analyse factors associated with this negative clinical event, with chest drain fall out defined objectively and consistently.

Methods

All documented chest drain insertions in our Trust in 2015 and 2016 were analysed retrospectively. Details of chest drain fall out were collected from patient electronic records, including documentation on discharge summaries, requests for radiology procedures and from radiology images. Drain "fall out" was pre-hoc defined on objective criteria as follows: the drain tip becoming dislodged outside the pleural cavity unintentionally before a clinical decision was taken to remove the drain.

The pleural team routinely use holding (anchoring) sutures (silk, 0.0) for chest drains, insert seldinger (non-locking) chest drains of size 12F mostly, and in addition use bio-occlusive or bespoke chest drain dressings (or both). The radiology team often do not suture chest drains, and insert chest drains of sizes 8F-12F, some of which are pigtail and mostly unlocked, and adhesive fabric dressings are usually used to strap the drain to the skin. A comparison of chest drain fall out rates between sutured and unsutured chest drains was carried out.

Independent T-test or Mann Whitney U test were used to compare continuous parametric and non-parametric variables respectively, and Chi square or Fisher's exact test were used to compare categorical variables between the groups. As an audit of practice, ethics approval for this study was not required.

Results

A total of 369 chest drains were inserted: 106 (28.7%) were sutured and 263 (71.3%) were unsutured. Table 1 shows the underlying cause for the effusion, duration of chest drain in situ, number of locked drains, drain type and size and ward patient was nursed on in the sutured and unsutured drain groups. Median overall duration of chest drains in situ was longer for sutured drains compared to unsutured drains (median 4 (IQR 4) days compared to median 2 (IQR3) days ($p=0.0001$, Mann Whitney U test). Twelve (11.3%) unsutured drains were pigtail catheters, compared to 119 (45.2%) of the sutured drains ($p<0.0001$, two-sided Fisher's exact test). Sutured drain sizes were 8-10F (n=3), 12F (n=99) and 18-24F (n=4), and unsutured drains were 8-10F (n=111), 12F (n=110), and insufficient data was available in 42 unsutured drains ($p<0.0001$, chi square 76.5, df 4). There was insufficient data documented for the dressings of the unsutured drains to enable comparison of drain fall out rates according to dressing types.

Of the drains that were sutured, 7 (6.6%) fell out after a mean 3.3 (SD 2.6) days, whereas 39 (14.8%) ($p=0.04$, two-sided Fisher's exact test) of the unsutured drains fell out after a mean 2.7 (SD 2.0) days ($p=0.8$). None of the sutured drains that fell out were locked, 2 of the unsutured drains that fell out were locked ($p=1.0$, two-sided Fisher's exact test). Despite unsutured drains being more likely to be smaller, there was no statistically significant difference in sizes of drains that fell out between the 2 groups ($p=0.1$, chi square 4, df 2). Also, despite patients with unsutured drains being more likely to be nursed on non-respiratory / cardiothoracic surgery wards ($p<0.0001$), there was no statistically significant difference in drain fall out between patients nursed on respiratory / cardiothoracic

surgery wards and those nursed on other wards (p=1.0, two-sided Fisher's exact test). There was also no statistically significant difference in underlying effusion cause (p=0.9, chi square 0.7, df 3).

Discussion

In the British Thoracic Society national pleural procedure audit in 2015,[2] 9.2% of chest drains fell out. Overall, our data shows a similar drain fall out rate (n=46, 12.5%), but a difference between unsutured chest drains (14.8%) and sutured drains (6.6%). This is likely to be an underestimate of the fall out rate, as if the drain fall out event did not alter clinical management, the utilised audit system may not have captured this data.

The results of this study suggest that a number of factors may be associated with reduced drain fall out rate. This includes size of chest drain used and the routine use of suturing. The TIME1 study demonstrated a higher rate of unintentional displacement of 12F chest drains compared to 24F chest drains (42 vs 28%), where all chest drains were sutured in as part of the trial protocol.[3] This very high fall out rate is likely related to the prospective (rather than retrospective) data collection, with prospective data being much more accurate in detection of complications with pre-hoc criteria.

Drain fall out rate in this study was not related to duration of chest drain in situ; rather, sutured drains remained in situ for an overall longer median duration of time (4 days compared to 2 days, $p<0.0001$), and were less likely to fall out (p=0.04). Neither was drain fall out related to the underlying cause for the effusion (p=0.2). Patients with sutured drains were more likely to be nursed on cardiothoracic or respiratory wards ($p<0.0001$), however drains that fell out were not more likely to be on non-respiratory / cardiothoracic wards than on other wards (p=1.0). Overall, patients with sutured chest drains were more likely to have larger chest drains inserted ($p<0.0001$ for sizes of chest drains between sutured and unsutured chest drains), however, comparison of the sizes of the drains that fell out did not reveal a difference (p=0.1).

Although this data is limited by its retrospective nature, lack of data on types of dressings used for the unsutured chest drains, and we were unable to compare chest drain insertion techniques by the various operators who inserted the sutured and unsutured chest drains, these results suggest that suturing of drains may be associated with lower fall out rates.

References

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	Sutured drains (n=106, 28.7%)	**Unsutured drains** (n= 263, 71.3%)	**p value**
Indication for chest drain insertion	-MPE (n=52) -HF/ hepatic hydrothorax (n=7) -empyema / parapneumonic (n=30) -other (n=17: traumatic (n=4), pneumothorax (n=4), post op (n=2), other (n=7))	-MPE (n=101), -HF /Hepatic hydrothorax (n=27), -empyema / parapneumonic (n=76), -other (n=56: post cardiac surgery (n=16), -other (n=43))	0.2 (Chi square 4.7, df 3)
Median duration (days) of chest drain in situ	4 (IQR 4)	2 (IQR 3) NB: insufficient data in 11 patients	**<0.0001** (Mann Whitney)
Number (%) of locked drains	5 (4.7)	27 (10.3)	0.1 (two- sided Fisher's exact test)
Drain type	Seldinger (n=94), pigtail (n=12, 11.3%)	Seldinger (n=144), pigtail (n=119, 45.2%)	**<0.0001** (two- sided Fisher's exact test)
Drain size	8F (n=1), 10F (n=2), 12F (n=99), 18F (n=3), 24F (n=1)	8F (n=94), 10F (n=17), 12F (n=110), NA (n=42)	**<0.0001** (Chi square 76.5, df 4)
Dressing type	For pleural drains: Bespoke+bio-occlusive (n=24); bespoke (n=7); bio-occlusive (n=13); NA (n=62)	Insufficient data available (n=263)	NA
Ward	Respiratory / Cardiothoracic (n=64, 60.4%), Other (n=42, (39.6%)	Respiratory / Cardiothoracic (n=75, 28.5%), Other (n=188, 71.5%)	**<0.0001** (Chi square 32.7, df 1)
<u>Drain fall outs:</u>			
Number of drains that fell out (%)	7 (6.6)	39 (14.8)	**0.04** (two-sided Fisher's exact test)
Mean number of days after which drains fell out	(3.3 days, SD 2.6)	(2.7 days, SD 2.0) NB: unclear date of fall out for n=1: excluded from analysis	0.8 (Mann Whitney)
Number of locked drains	0	2	1.0 (two-sided Fisher exact test)
Size of drains	10F (n=1), 12F (n=6)	8F (n=15), 10F (n=3), 12F (n=21)	0.1 (Chi square 4, df 2)
Underlying cause for pleural effusion	MPE (n=3), infection (n=3), other (n=1: postop (n=1))	MPE (n=21, HF (n=1), infection (n=14), Other (n=3: PE (n=1), hypoalbuminaemia (n=1), chylothorax (n=1))	0.9 (Chi square 0.7, df 3)
Ward	respiratory/cardiothoracic (n=2), other (n=5)	respiratory / cardiothoracic (n=14), other (n=25)	1.0 (two-sided Fisher's exact test)

Table 1 shows a comparison between sutured and unsutured chest drains. *MPE= malignant pleural effusion; HF=heart failure-related; postop=postoperative; IQR=inter-quartile ratio; NA=not available; df=degrees of freedom; SD=standard deviation*