

Practical Report

An investigation of exudate management at chest tube insertion sites in patients with malignant pleural effusion

Natsuki Asaumi¹⁾; Sayuri Tone²⁾ and Asuka Tomita^{2)*}

¹⁾ *Department of Fundamental Nursing, Faculty of Health Sciences, Yamaguchi University Graduate School of Medicine*

²⁾ *Yamaguchi University Hospital, Nursing Department*

* *Present affiliation: Medical Corporation Emainal, Emainal Clinic Hiroshima Branch*

Introduction

Exudate leakage from the chest tube insertion site is a known issue associated with chest tube-related complications and patient discomfort¹⁾. A chest tube is a medical device used to continuously drain air, pleural fluid, or blood from the pleural cavity. Previous studies have noted that exudate leakage can predispose patients to infection and compromise the surrounding skin¹⁾. Therefore, appropriate management of drainage leakage is crucial for maintaining and improving patients' quality of life.

Nurses generally manage exudate leakage from chest tube insertion sites by applying absorbent dressings while taking measures to prevent leakage from the dressing itself. Wood et al.²⁾ reported that when absorbent dressings or gauze were applied and replaced every 3 days, the dressings effectively absorbed the exudate without requiring more frequent changes.

However, persistent leakage from insertion sites raises concerns regarding complication risk and patient discomfort. Ault et al.¹⁾ reported a case in which repeated dressing changes failed to prevent exudate from leaking outside the dressing, resulting in the patient's clothing becoming soaked. In response a fluid collection pouch was placed over the insertion site to capture the exudate. Nevertheless, such reports are limited to single-case reports, and research on nursing care to prevent exudate leakage

from dressings remains scarce.

Wood et al.²⁾ did not restrict eligible conditions or treatments for chest tube insertion, whereas Ault et al.¹⁾ focused specifically on patients with malignant pleural effusion. Malignant pleural effusion, caused by the spread of cancer cells into the pleural cavity leading to fluid accumulation, occurs in approximately 15% of patients with cancer³⁾. When pleural effusion accumulation induces dyspnea, chest tube insertion is recommended for continuous drainage, followed by pleurodesis to prevent recurrence⁴⁾. Because pleural effusion accumulates to the extent that it compresses the lungs and causes dyspnea³⁾, patients with malignant pleural effusion undergoing chest tube insertion are expected to experience greater exudate leakage than other patient populations.

Research on the management of exudate from chest tube insertion sites in patients with malignant pleural effusion is limited to a case study reported by Ault et al.¹⁾. To date, no nationwide survey has been conducted, and no studies have quantitatively described the use of dressings at chest tube insertion sites or the implementation of care to prevent exudate leakage from applied dressings.

Based on this background, the present study aimed to clarify the current practice in exudate management from chest tube insertion sites in Japan through a nationwide questionnaire survey targeting nurses who have experience in managing such patients. The significance of this study lies in quantitatively

elucidating current practices in exudate management at chest tube insertion sites, which is expected to provide fundamental data for the standardization of care and the development of new nursing techniques.

Method

1. Study design

This study employed a cross-sectional design.

2. Participants

Participants were nurses, including licensed practical nurses, who had experience in managing the chest tube insertion sites in patients with malignant pleural effusion.

3. Survey method

The survey was conducted from September to October 2022 using mail and online questionnaires. The target population comprised 105 hospitals with respiratory medicine wards. To ensure equal representation of facility sizes, hospitals were stratified based on bed capacity. The country was categorized into seven regions (Hokkaido, Tohoku, Kanto, Chubu, Kansai, Chugoku/Shikoku, and Kyushu). In each region, five hospitals were selected per bed category (< 300, 301–500, and ≥ 501 beds), yielding 15 hospitals per region. Assuming 20 participants per hospital, the target sample size was 2,100.

Written requests for cooperation and consent documents were mailed to nursing directors of the selected hospitals. Directors who agreed to participate distributed consent materials to potential participants at their discretion. Nurses who consented to participate accessed the online questionnaire via the QR code or URL provided in the consent form and completed the survey.

4. Questionnaires

1) Personal attributes

Respondents provided their age, sex, ward affiliation, years of service in the ward, and total years of nursing experience. In addition, they were asked whether they had experienced exudate leakage from the dressing at a chest tube insertion site that soiled a patient's clothing, with responses recorded as either "yes" or "no."

2) Type and number of dressings applied to the chest tube insertion site

In Japan, Y-cut gauze (hereafter referred to as "split gauze") and square gauze folded into four layers (hereafter referred to as "gauze") are commonly used;

therefore, these were included as response options^{5) 6)}. To avoid discrepancies in the perceived number of gauze pieces due to differences in folding methods, gauze was specified as "gauze (square gauze folded into four layers)." Respondents indicated all types of gauze applied to the chest tube insertion site and the number of pieces used per application. If "other" was selected, respondents were asked to specify the dressing used.

3) Care to prevent exudate leakage from dressings at the chest tube insertion site

For nursing care addressing exudate leakage from dressings applied to chest tube insertion sites, in addition to frequent dressing changes as reported in previous studies, other possible measures include increasing the number of gauze pads applied to the insertion site, and placing highly booster pads with a waterproof backing sheet over the dressing to prevent external leakage⁷⁾. Based on these considerations, the following response options were set: "1. Increase frequency of dressing changes," "2. Increase the number of split gauze or gauze applied to the insertion site," "3. Apply booster pads over the dressing at the insertion site," "4. No specific measures taken," and "5. Other." Participants who selected "5. Other" were asked to freely describe the nursing care for exudate leakage.

5. Statistical analysis

The data were aggregated, and the percentage of respondents for each item was calculated. Differences in the number of gauze pads were examined according to participant characteristics. For both split gauze and gauze, the distribution and variability were assessed, and descriptive statistics were calculated. As the data were not normally distributed, the Mann-Whitney U test and the Kruskal-Wallis test were used for group comparisons, as appropriate. When a significant difference was detected, post hoc multiple comparisons were conducted using Dunn's test with Bonferroni correction. Statistical analyses were performed using JMP Student Edition 19 for Windows, with the significance level set at 5%.

6. Ethical considerations

The Research Ethics Review Committee of the Department of Health Sciences, Graduate School of Medicine, Yamaguchi University approved this study (Ethics Review Number 711-1).

The consent form explained the study purpose and

methods, anonymity of data, and voluntary nature of participation. It also stated that participants would not face any disadvantage if they declined or discontinued the survey.

All responses were anonymized and statistically processed to prevent identification. Data were collected solely for this study, and no identifying information will appear in presentations or publications. Participants who agreed to participate in this study accessed the questionnaire via a QR code or URL provided in the consent form. The web-based questionnaire was designed for anonymous completion, and consent was confirmed when participants clicked the "Submit Responses" button on the final page.

The survey was conducted using the web questionnaire system provided by Select Type Co., Ltd., which offers internet rental servers and ASP services. The company has implemented appropriate security measures in compliance with relevant laws and regulations on personal information protection.

Result

Of the 2,100 individuals surveyed, 116 responded (response rate: 5.5%). Data from 107 participants were analyzed after excluding eight respondents who answered "no" to the question regarding experience in managing chest tube insertion sites in patients with malignant pleural effusion and one respondent who reported being in their teens (valid response rate: 92.2%). Regarding the number of gauze pads, when responses were provided as ranges (e.g., "5–10"), the mean value of the indicated range was calculated and used for analysis.

1. Dressings usage and comparison by characteristics

Participants in their 20s constituted the largest age group, whereas those in their 50s represented the smallest group. Regarding ward affiliation, respiratory medicine had the highest number of patients, followed by respiratory medicine and surgery. Other wards included palliative care units and mixed wards that included respiratory medicine and internal medicine. A total of 97 participants (90.7%) reported having experienced exudate leakage, while 10 (9.3%) reported no such experience (Table 1).

Regarding the types of dressings, 77 of the 107 participants (72.0%) used split gauze at the chest tube

insertion site, with a mean of 1.5 ± 0.9 pieces (range, 1–5) and a median of 1 (interquartile range, 1–2). Gauze was reported by 64 (59.8%) participants, with a mean of 8.6 ± 4.8 pieces (range, 1–30), a median of 10, and an interquartile range of 5–10. No respondents (0%) reported omitting dressings. Thirty-seven participants (34.6%) selected "other," specifying surgical pads ($n = 10$), absorbent adhesive dressing ($n = 7$), transparent adhesive dressing ($n = 7$), and booster pads ($n = 4$). Participants also reported factors influencing the number of dressings, such as "adjusting the number of dressings based on the amount of exudate" ($n = 5$) and "applying 10 dressings and increasing the number if a change is needed during the night" ($n = 1$).

A significant difference was observed in the number of split gauze pads between the respiratory medicine ward and the combined respiratory medicine and surgery ward ($P = 0.0141$). In contrast, no significant differences were found in the other variables. No significant differences were observed in the number of gauze pieces across any of the items (Table 1).

2. Care to prevent leakage of exudate from the dressing at the chest tube insertion site

We compiled the responses of 97 people who had experienced exudate leakage. The most common response was "2. Increase the number of split gauze or gauze applied to the insertion site," and no one answered "4. No specific measures taken." Responses in the "Other" category included responses such as "Apply a surgical pad over the applied dressing" ($n = 7$), "Apply a transparent adhesive dressing over the applied gauze" ($n = 3$), "Apply a surgical pad over the transparent adhesive dressing" ($n = 2$), and "Request additional sutures from the physician" ($n = 1$) (Table 2).

Discussion

In this study, as more than 90% of nurses reported experiencing fluid leakage, this suggests that patients' clothing is frequently soiled due to leakage from the dressing at the chest tube insertion site in patients with malignant pleural effusion. Previous reports have indicated that, in the absence of restrictions related to patient condition or treatment type, two drainage sponges were applied to the insertion site, followed by two gauze pads³⁾. Compared with the mean number of

Table 1 Comparison of the number of gauze pads by characteristics (N = 107)

Item	N	%	number of selections per item	The number of split gauze		number of selections per item	The number of gauze	
				Median (interquartile range)	P		Median (interquartile range)	P
Age								
20s	36	33.7	23	1 (1-2)	n.s	20	10 (5-10)	n.s
30s	35	32.7	22	1 (1-2)		20	10 (5-10)	
40s	27	25.2	22	1 (1-1)		17	5 (4-10)	
≥ 50s	9	8.4	7	1 (1-2)		2	7.5 (5-10)	
Sex								
Male	6	5.6	3	1 (1-2)	n.s	5	10 (5-10)	n.s
Female	101	94.4	72	1 (1-2)		54	10 (5-10)	
Ward affiliation								
Respiratory medicine	41	38.3	28	2 (1-2)	] < 0.05*	24	10 (5-10)	n.s
Respiratory medicine and surgery	37	34.6	29	1 (1-1)		19	10 (5-10)	
Other	29	27.1	18	1 (1-2)		16	10 (5-10)	
Years of service in the ward								
< 5 years	74	69.2	49	1 (1-2)	n.s	45	10 (5-10)	n.s
5–10 years	26	24.3	20	1 (1-2)		10	10 (5-10)	
> 10 years	7	6.5	6	1 (1-2)		4	5 (3-5)	
Years of experience as a nurse								
< 5 years	25	23.4	18	1 (1-2)	n.s	15	10 (5-10)	n.s
5–10 years	25	23.4	15	1 (1-2)		13	10 (10-10)	
10–15 years	18	16.8	12	1 (1-2)		12	10 (5-10)	
15–20 years	14	13.0	10	1 (1-2)		8	5 (5-10)	
> 20 years	25	23.4	20	1 (1-2)		11	10 (3-10)	
Experience with leaks from dressings								
With experience	97	90.7	69	1 (1-2)	n.s	54	10 (5-10)	n.s
without experience	10	9.3	6	1 (1-5)		5	10 (5-7.5)	

*P < 0.05 Mann-Whitney U test or Kruskal-Wallis test; Dunn's test with Bonferroni correction for multiple comparisons

Table 2 Care to prevent leakage of exudate from the dressing at the chest tube insertion site (multiple answers allowed) N = 97

	N	%
1. Increase frequency of dressing changes	66	67.3
2. Increase the number of split gauze or gauze applied to the insertion site	73	74.5
3. Apply booster pads over the dressing at the insertion site	49	50.5
4. No specific measures taken	0	0
5. Other	19	19.4

gauze pads used in the present study, the number of split gauze pads used was similar, whereas the number of gauze pieces tended to be higher. Furthermore, as each preventive measure was implemented by more than half of the nurses, this implies that these strategies are often combined based on the patient's condition. In addition, more than half of the respondents reported applying highly absorbent medical supplies, such as booster pads or surgical

pads, as secondary dressings. These results indicated that nurses frequently rely on additional absorbent materials to manage leakage and prevent soiling of patients' clothing. Given that patients with malignant pleural effusion typically produce approximately 1–1.5 L of drainage per day⁴⁾, the high drainage volume may influence the amount of exudate leakage from the insertion site.

Previous studies have reported that methods for

protecting chest tube insertion sites are determined on a ward-by-ward basis²⁾. Therefore, the significant difference in the number of split gauze pads used in this study across wards may reflect differences in care policies between wards. On the other hand, no significant differences were observed with respect to nurses' years of experience, ward experience, or prior experience with drainage leakage. Furthermore, given that some nurses adjusted the number of dressings applied to the tube insertion site according to the amount of drainage, this suggests that the number of dressings is determined based on fluctuations in the patient's drainage volume rather than the nurse's experience.

The use of drainage pouches, as reported in a previous study¹⁾, was not observed in this study. The subjects in Ault et al.'s study¹⁾ were patients using PleurX devices, which are intended for long-term placement and intermittent drainage in the management of pleural effusion at home. In Japan, PleurX is not commonly used⁸⁾; instead, thoracic trocars or aspiration kits are often used in conjunction with continuous suction devices⁹⁾. Furthermore, although drainage pouches have been reported in association with semi-closed drains⁹⁾, no reports have described their use with closed chest tube insertion sites. These findings suggested that exudate management at chest tube insertion sites is influenced, at least in part, by the structure of the drain and the drainage method.

The response rate in this study was low (5.5%), which may be attributed to the survey period overlapping with the Coronavirus disease 2019 pandemic. Additionally, requesting detailed information on dressing materials may have increased respondent burden. The relatively small sample size ($n=107$) limits the generalizability of the findings and raises concerns about the possibility of response bias. Moreover, as the specific job titles of respondents were not identified, potential role-related bias could not be assessed. Although stratified sampling was employed, the absence of data on the hospital bed numbers introduces the possibility of bias related to bed capacity or sampling distribution.

The significance of this study lies in its clarification of current practices in the management of exudate at chest tube insertion sites, an area previously reported primarily through individual case studies. Given the frequent reports of bedding contamination due to

exudate leakage and the widespread use of additional absorbent materials or secondary dressings as countermeasures, these findings suggested that improvements are needed in the absorbency and retention capacity of existing dressing materials. Future research should focus on the objective quantification of exudate volume and its temporal changes. Furthermore, these findings may support the development of highly absorbent dressing materials and novel medical solutions.

Conclusion

More than 90% of nurses reported experiencing exudate leakage from the dressings. There was a significant difference in the number of split gauze pads across wards, which may reflect differences in care policies between wards. On the other hand, no significant differences were observed based on years of experience or prior experience with fluid leakage. Furthermore, open-ended responses suggested that the number of dressing materials used is determined based on the amount of exudate leakage from the insertion site. Since more than half of the nurses increased the number of gauze pads or applied a secondary dressing to prevent exudate leakage, this indicates that the absorbency and retention capacity of current dressings may be inadequate. Future studies should clarify the actual extent of exudate leakage from drainage sites in patients with malignant pleural effusion.

Acknowledgements

We would like to express our sincere gratitude to all the nurses who participated in this study.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

References

- 1) Ault M, Tanabe R, Galvez K. Drainage pouch: palliating the persistent leak. *Medsurg Nurs* 22: 125-127, 2013.
- 2) Wood MD, Powers J, Rechter JL. Comparative evaluation of chest tube insertion site dressings: a randomized controlled trial. *Am J Crit Care* 28: 415-423, 2019.

- 3) Dipper A, Jones HE, Bhatnagar R, et al. Interventions for the management of malignant pleural effusions: a network meta-analysis. Cochrane Database Syst Rev 4: CD010529, 2020.
- 4) Japanese Society for Palliative Medicine. 4. がん患者の呼吸困難に関連する特定病態. 進行性疾患患者の呼吸困難の緩和に関する診療ガイドライン 2023 年版, 33-35, KANEHARA & CO., LTD., Tokyo, 2023. (In Japanese)
- 5) Kusaka E, Abe M, Ohmura K. 重症な子どものベッドケア 特殊な治療下の安全の確保とケアの要点 胸腔ドレーンの固定 (1). The Japanese Journal of Child Nursing, Monthly 44: 608-612, 2021. (In Japanese)
- 6) Naito M, Shinohara K. 胸腔ドレーンの固定方法に関する調査. The Japanese Journal of Ergonomics 41: 98-99, 2005. (In Japanese)
- 7) Fader M, Cottenden A, Chatterton C, et al. An International Continence Society (ICS) report on the terminology for single-use body worn absorbent incontinence products. Neurourol Urodyn 39: 2031-2039, 2020.
- 8) Ministry of health labor and welfare. 中央社会保険医療協議会保健医療材料専門部会 意見陳述資料 (2025). 2026/03/18, [https://www.mhlw.go.jp/content/10808000/001548658.pdf]
- 9) Kubota K. PART1. ドレナージの理解. ドレーン・カテーテル・チューブ管理完全ガイド第4版, 9-30, Shorinsha, Tokyo, 2020. (In Japanese)

実践報告

悪性胸水患者における胸腔ドレーン挿入部からの 滲出液管理に関する実態調査

浅 海 菜 月¹⁾・刀根沙由理²⁾・富田明日香^{2)*}

¹⁾ 山口大学大学院医学系研究科保健学専攻基礎看護学講座

²⁾ 山口大学医学部附属病院看護部

*現所属：医療法人社団エミナルエミナルクリニック広島院

Key message (著者からのメッセージ)

1. 今回の研究は看護・介護のどのような問題をテーマにしているのか？

研究を行うきっかけとなったことはどのようなことか？

本研究は胸腔ドレーン挿入部における合併症リスクや、胸腔ドレーン挿入中の患者の苦痛を軽減させる方法は何かという問題をテーマにしている。

2. この研究成果が看護・介護にどのように貢献できるのか？あるいは、将来的に貢献できることは何か？

本研究の成果は、ドレーン挿入部からの滲出液を管理する新しい方法の開発に寄与する可能性がある。これにより、胸腔ドレーン挿入部に関連する合併症のリスクおよびドレーン挿入中の患者の苦痛の軽減に貢献する。

3. 今後どのような技術が必要になるのか？

より高い吸収性能を有するドレッシング材や、滲出液をより適切に管理できる新たな方法を開発する必要がある。