ORIGINAL ARTICLE

ASSESSMENT OF CHEST TUBE MANAGEMENT KNOWLEDGE AMONG CRITICAL CARE NURSES IN A TERTIARY CARE CARDIAC HOSPITAL: A DESCRIPTIVE STUDY

Hamayat Ullah[1], Rahmat Nawaz[2], Asif Raza Rathore[3], Shahzad Bashir[1], Maria khan[4], Ikram Hassan[3], Muhammad Ishaq Khan[3], Saddam Hussain[3], Hammad Khan[5]

[1]Ziauddin University Faculty of Nursing and Midwifery Karachi Pakistan, [2]Khyber Teaching Hospital Peshawar, [3]National Institute of Cardiovascular Diseases (NICVD) Karachi, Pakistan, [4]Faculty of Pharmacy Shaheed Benazir Bhutto Dewan University Karachi Pakistan, [5]College of Nursing (Male) Korangi Karachi Pakistan

Objectives: Chest tubes play a critical role in managing intra-pleural pressure imbalances and preventing potentially fatal outcomes such as pulmonary collapse. The management of chest tubes is primarily the responsibility of nursing care in patients reliant on this intervention. This study aimed to assess the level of knowledge regarding chest tube management among critical care nurses at a tertiary care cardiac hospital in Karachi, Pakistan.

Methodology: This descriptive cross-sectional study utilized a convenient sampling method, involving a sample size of n=120 participants. Data collection involved a structured questionnaire comprising demographic parameters followed by an 18-item questionnaire assessing knowledge of chest tube management. Knowledge scores were calculated as the percentage of correct responses to the 18 knowledge-related questions.

Results: Among the 120 nurses surveyed, 59.2% (71) were male, 55% (66) were under 36 years of age, and 66.7% (80) had up to 10 years of work experience. Only 20% (24) had participated in training courses regarding thoracic diseases. The mean knowledge score was 57.3 ± 17.2, with 30% (36) categorized as having low knowledge (<50%), 65% (78) as moderate knowledge (50% to 80%), and 5% (6) as high knowledge (>80%).

Conclusion: The study revealed a moderate level of knowledge concerning chest tube management among critical care nurses in a tertiary care cardiac center. There is a need for structured and comprehensive training programs focusing specifically on chest tube management to enhance nurses proficiency in this critical area of patient care.

Keywords: chest tube management; knowledge; nurses; cardiac care

INTRODUCTION

Chest tubes, crucial tools in medical intervention, are flexible tubes inserted through the chest wall, between the ribs, and into the pleural cavity. Their primary role involves the drainage of various substances from the chest, including air, blood, fluids, or pus, as evidenced by numerous studies.[1,2] Commonly employed in clinical practice, the insertion of a chest tube, known as thoracostomy, is a standard surgical procedure utilized for draining fluid, blood, or air from the pleural cavity. This therapeutic approach is frequently applied in the management of respiratory conditions, cardiac surgeries, thoracic surgeries, and trauma cases.

However, the insertion and care of chest tubes demand a high level of expertise and skill to mitigate potential risks to the respiratory system.[3,4]

Also known as intercostal catheters, chest tubes are pliable plastic tubes utilized for evacuating air (Pneumothorax), fluid (pleural effusion), blood, or purulent material (empyema) from the mediastinal cavity or pleural space.[5-7] Typically, these tubes remain in place post-thoracic or cardiac surgery until the output decreases to less than 150 ml in 24 hours, and any air leaks are resolved.[8-10] Positioned in the pleural space rather than the lungs, chest tubes are inserted between the parietal and visceral pleurae. The outer layer, the parietal pleura, covering the chest wall

and diaphragm, contains a small amount of serous fluid, reducing friction and enhancing pleural surface adhesion.[8]

Various conditions necessitate the placement of chest tubes, including pneumothorax, pleural effusion, chylothorax, empyema, hemothorax, and the administration of sclerosing agents for pleurodesis. Additionally, cardiothoracic procedures and chest traumas often require chest tube insertion.[11] Given the critical role of respiration in sustaining life, healthcare professionals must possess adequate knowledge and skills in chest tube management, including preparation, ongoing patient assessment, documentation, and the identification of potential complications.[12]

While physicians are responsible for the aseptic insertion of chest tubes, nurses play a crucial role in monitoring chest drainage, suction levels, recording effluent volumes, wound care, pain management, and providing support and information to patients and their families. Inadequate management of these responsibilities can lead to serious consequences such as respiratory complications, increased morbidity, prolonged hospital stays, and in rare cases fatalities.[13,14]

Several studies have highlighted challenges and misconceptions in nursing practices related to chest tube management. For instance, a survey-based study revealed discrepancies in nursing behaviors related to chest tube maintenance, with some nurses incorrectly believing that milking or stripping chest tubes maintained their patency.[15,16] Another study found deficiencies in nurses knowledge regarding proper chest tube insertion methods.[17,18] However, interventions such as educational programs have shown promising results in improving nursing practice in this area.[19]

Despite the critical importance of sound nursing knowledge in chest tube management, studies from various regions worldwide have shown insufficient knowledge among nursing staff, leading to potential uncertainties and risks for patients with chest tubes.[20] Therefore, this study aims to evaluate the knowledge of nurses working in critical care units regarding chest tube management at a tertiary care hospital in Karachi, Pakistan.

METHODOLOGY

Study Design: This study employed a descriptive cross-sectional design to explore the knowledge level of critical care nurses regarding chest tube management.

Setting: The investigation took place in all critical care units of the National Institute of Cardiovascular Diseases (NICVD) Karachi, including the Surgical Intensive Care Unit (SICU), Pediatric Intensive Care Unit (PICU), and Cardiac Care Units (CCU-I, CCU-II, and CCU-III).

Participants: The target population comprised critical care nurses working in the aforementioned units. Nurses with less than one year of experience were excluded from the study.

Variables: The main variable of interest was the knowledge level of critical care nurses regarding chest tube management. Demographic variables such as gender, age, experience, working area, education, and designation were also considered.

Data Sources/Measurement: Data was collected using a questionnaire that consisted of two parts. The first part included demographic questions, while the second part contained 18 questions assessing knowledge related to chest tube management. A knowledge score was computed based on the percentage of correct responses to the 18 questions.

Bias: Efforts were made to minimize bias by excluding nurses with less than one year of experience and ensuring the anonymity and confidentiality of participants. Additionally, the questionnaire used was pre-tested and validated in a previous study.[21]

Study Size: A total of 120 critical care nurses participated in the study, selected through non-probability sampling methods. This sample size was deemed adequate for assessing the knowledge level of critical care nurses regarding chest tube management within the context of the National Institute of Cardiovascular Diseases (NICVD) Karachi.

Quantitative Variables: Quantitative variables included the knowledge score, which was categorized as low (less than 50%), moderate (50-80%), or high (greater than 80%).

Statistical Methods: Data analysis was conducted using SPSS version 21. Descriptive statistics such as mean ± standard deviation, frequency, and percentage

were used to report outcomes. The mean knowledge level and distribution of knowledge scores were compared across various baseline characteristics using independent sample t-tests, one-way analysis of variance (ANOVA), or Chi-square tests. Statistical significance was determined by a p-value ≤ 0.05.

Ethical Considerations: The study was approved by the Institutional Review Board (IRB) of NICVD Karachi, and informed consent was obtained from all participants. Confidentiality and the right to refuse participation were ensured, and no adverse effects were associated with the study.

RESULTS

Participants: The study included a total of 120 critical care nurses from various units of the National Institute of Cardiovascular Diseases (NICVD) Karachi. Among them, 71 (59.2%) were male, and 49 (40.8%) were female. The age distribution showed that 66 (55%) participants were up to 35 years old, while 54 (45%) were between 36 and 60 years old. Regarding qualifications, 15 (12.5%) participants held a diploma in nursing, 81 (67.5%) had completed post-RN training, and 24 (20%) possessed a Bachelor of Science in Nursing (BSN) degree. Furthermore, 80 (66.7%) participants had up to 10 years of nursing experience, while 40 (33.3%) had more than ten years of experience. The participants were distributed across various working areas, with 8 (6.7%) in CCU-I, 26 (21.7%) in CCU-II, 27 (22.5%) in CCU-III, 22 (18.3%) in PICU, and 37 (30.8%) in SICU. Regarding training courses related to thoracic diseases, 96 (80%) participants had no prior training experience, while 24 (20%) had undergone relevant training.

Descriptive Data: Table 2 presents the percentage and number of individuals who provided correct responses to each question in the questionnaire. The questions covered various aspects of thoracic anatomy and chest tube management. The correct response rates ranged from 30.8% to 87.5%, indicating variability in participants knowledge levels across different topics.

Outcome Data: The statistical outcomes presented in Table 3 depict the distribution of participants knowledge scores based on demographic variables such as gender, age, level of qualification, years of experience, area of work, and participation in training courses. The mean knowledge scores ranged from 49.6% to 69.7%, with considerable variation observed across different groups.

Table 1: Demographic frequency of selected participants

Variables	Frequency (%)
Total (N)	**120**
Gender	
Male	71 (59.2%)
Female	49 (40.8%)
Age	
Up to 35 years	66 (55%)
36 to 60 years	54 (45%)
Level of Qualification	
Diploma Nursing	15 (12.5%)
Post RN	81 (67.5%)
BSN	24 (20%)
Experience (years)	
Up to 10 years	80 (66.7%)
More than ten years	40 (33.3%)
Area of Working	
CCU-I	8 (6.7%)
CCU-II	26 (21.7%)
CCU-III	27 (22.5%)
PICU	22 (18.3%)
SICU	37 (30.8%)
Participation in training courses regarding thoracic disease	
No	96 (80%)
Yes	24 (20%)

HUTT=head-up tilt table

Main Results: Overall, the analysis revealed moderate knowledge levels among participants, with mean knowledge scores ranging from 49.6% to 69.7%. There were no significant differences in knowledge scores based on gender, age, level of qualification, years of experience, or area of work. However, participation in training courses related to thoracic diseases significantly influenced knowledge scores, with participants who had undergone training demonstrating significantly higher scores compared to those without training (p < 0.001). This finding highlights the importance of continued education and training in enhancing critical care nurses knowledge in specific clinical areas.
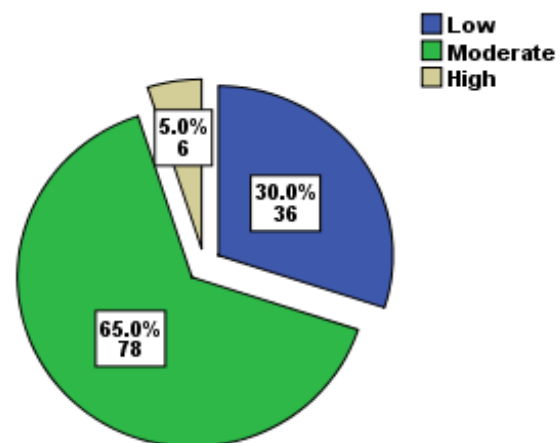

Figure 1: Knowledge scores from our designed questionnaire

Table 2: Representation of questionnaire, number of individuals, and percentage of correct responses

Variables	Individuals Correct Responses Frequency (%)
Q1: The anatomical structure located in the center of the thoracic cavity is the__	105 (87.5%)
Q2: The anatomical membrane that covers the internal wall of the thoracic cavity is__	79 (65.8%)
Q3: The anatomical membrane that covers the lungs is__	62 (51.7%)
Q4: The anatomical membrane that covers the heart, part of the esophagus, and great blood vessels is__	49 (40.8%)
Q5: Which of the following statements about intra-pleural pressure under normal conditions is true?	77 (64.2%)
Q6: Pleural fluid in the pleural cavity is produced by the small intercostal arteries through__	52 (43.3%)
Q7: Chest drains are supplied in different sizes according to an external diameter__	62 (51.7%)
Q8: The specialized physician depends on to select the size of chest drain__	43 (35.8%)
Q9: The chest drainage system should have a design that made its level below the chest drain__	56 (46.7%)
Q10: A one-bottle chest drainage system can collect fluids and prevent air from return to the Pleural cavity__	75 (62.5%)
Q11: One of these physical concepts is wrong in the one-bottle chest drainage system__	48 (40%)
Q12: Chest drainage system is a disposable sterile system contains container with one-way Valve and one or more bottle, due to__	77 (64.2%)
Q13: Normal intra pleural fluid inside the pleural cavity is per Kg__	73 (60.8%)
Q14: Primary spontaneous Pneumothorax is caused By__	59 (49.2%)
Q15: The most urgent type of pneumothorax is__	90 (75%)
Q16: Which is one of pleural effusion types__	37 (30.8%)
Q17: The placement of the chest drains in case of pneumothorax it should be inserted__	89 (74.2%)
Q18: Broncho-pleural fistula is a__	104 (86.7%)

Table 3: Statistical outcomes from the questionnaire in Gender, age, level of qualification, experience, area of working, and training experience

	Total (N)	Knowledge score	P-value	Knowledge level Low	Moderate	High	P-value
	120	57.3 ± 17.2	-	36 (30%)	78 (65%)	6 (5%)	-
Gender							
Male	71	56.4 ± 17.1	0.518	21 (29.6%)	48 (67.6%)	2 (2.8%)	0.397
Female	49	58.5 ± 17.5		15 (30.6%)	30 (61.2%)	4 (8.2%)	
Age							
Up to 35 years	66	57.8 ± 17	0.696	20 (30.3%)	43 (65.2%)	3 (4.5%)	0.968
36 to 60 years	54	56.6 ± 17.6		16 (29.6%)	35 (64.8%)	3 (5.6%)	
Level of qualification							
Diploma nursing	15	49.6 ± 21		6 (40%)	9 (60%)	0 (0%)	
Post RN	81	58.4 ± 16.9	0.186	23 (28.4%)	52 (64.2%)	6 (7.4%)	0.455
BSN	24	58.1 ± 14.9		7 (29.2%)	17 (70.8%)	0 (0%)	
Year of experience in nursing							
Up to 10 years	80	56.9 ± 17.1	0.724	26 (32.5%)	49 (61.3%)	5 (6.3%)	0.413
More than 10 years	40	58.1 ± 17.7		10 (25%)	29 (72.5%)	1 (2.5%)	
Area of working							
CCU-I	8	57 ± 15.1		3 (37.5%)	5 (62.5%)	0 (0%)	
CCU-II	26	55.6 ± 17.2		10 (38.5%)	13 (50%)	3 (11.5%)	
CCU-III	27	54.3 ± 17.9	0.748	9 (33.3%)	18 (66.7%)	0 (0%)	0.544
PICU	22	59.6 ± 16.6		5 (22.7%)	16 (72.7%)	1 (4.5%)	
SICU	37	59.3 ± 18		9 (24.3%)	26 (70.3%)	2 (5.4%)	
Participation in training courses regarding thoracic disease							
No	96	54.2 ± 17.8	<0.001	36 (37.5%)	55 (57.3%)	5 (5.2%)	0.001
Yes	24	69.7 ± 5.7		0 (0%)	23 (95.8%)	1 (4.2%)	

DISCUSSION

In critical care units and related healthcare settings, nurses play a pivotal role in the monitoring, diagnosis, and management of patients with chest tubes. Previous studies conducted in Peshawar and Services Hospital Lahore have highlighted the inadequate knowledge of nurses regarding chest tube management.[22] In the present study, which involved 120 participants from critical care units at NICVD Hospital Karachi, the assessment of expertise among nurses revealed varying levels of understanding regarding chest tube drainage and control. Specifically, 30% of participants exhibited limited comprehension, while 65%

demonstrated a moderate level of knowledge through correct responses. Remarkably, 5% of participants exhibited excellent knowledge of chest tube drainage care. This aligns with previous findings indicating that a majority of participants typically exhibit moderate to poor knowledge, often due to a lack of prior training experience.

Another study conducted in North Gujrat, comprising 70 participants, similarly found that most nurses exhibited poor knowledge of chest tube management.[23] In-depth analysis of variables such as age, gender, level of education, area of work, and prior training related to chest tube management revealed noteworthy insights. While both genders displayed comparable knowledge scores, participants under 35 years of age showed slightly higher scores (57.8 ± 17) compared to those over 35 years (56.6 ± 17.6). The level of qualification significantly influenced knowledge scores, with participants holding a nursing diploma scoring lower (49.6 ± 21) than those with a Post RN (58.4 ± 16.9) or BSN (58.1 ± 14.9). Experience also contributed to knowledge scores, albeit to a lesser extent, with participants having more than ten years of experience scoring slightly higher (58.1 ± 17.7) than those with less than ten years (56.9 ± 17.1).

Interestingly, the area of working did not significantly affect knowledge scores, indicating that it is independent of the level of knowledge among nurses. However, prior training showed considerable variations in statistical outcomes, with participants who had undergone training demonstrating significantly higher knowledge scores (69.7 ± 5.7) compared to those without training experience (54.2 ± 17.8). This trend is consistent with previous research findings, underscoring the importance of training programs in enhancing nurses knowledge and proficiency in chest tube management.[24]

Numerous studies conducted globally have identified inadequate knowledge among nurses regarding chest tube management, attributed to factors such as the absence of pre- and post-degree training programs, inadequate supervision, and shortcomings in the assessment system for nurses.[23] Addressing these issues through comprehensive training initiatives and improved supervision can potentially mitigate knowledge gaps and enhance patient care outcomes in critical care settings.

LIMITATION

The study had several limitations that warrant consideration. Firstly, the sample size of 120 participants might not have been sufficient to generalize the study outcomes to the broader population of critical care nurses. Additionally, the relatively short duration of the study period may have limited the ability to analyze prospective events or establish detailed associations between practices and knowledge levels. Moreover, the use of a convenient sampling procedure could introduce biases into the study findings, potentially impacting the validity and generalizability of the results.

RECOMMENDATIONS

Based on the study findings, several recommendations can be made to address the identified limitations and improve chest tube management practices among critical care nurses. Structured and comprehensive training programs should be developed, focusing specifically on chest tube management. These programs should incorporate both theoretical and practical components to ensure a holistic understanding of the subject matter. Collaboration with respiratory therapists, surgeons, and radiologists should be encouraged to provide nurses with a broader perspective on patient care and facilitate interdisciplinary teamwork. Furthermore, the development and maintenance of consistent procedures and standard operating procedures (SOPs) for chest tube management are essential. These materials should be readily accessible to nurses as a reference for best practices in chest tube care.

CONCLUSION

In conclusion, the study revealed a moderate level of knowledge among critical care nurses regarding chest tube management in a tertiary care cardiac center. To address the identified limitations and improve patient care outcomes, it is imperative to implement structured training programs focused on chest tube management. By incorporating interdisciplinary collaboration and standardizing procedures, healthcare facilities can enhance nurses proficiency in managing chest tubes effectively.

AUTHORS' CONTRIBUTION

HU and RN: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. HU, RN, ARR, SB, MK, IH, MIK, SH, and HK: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

Disclaimer: None.

Conflict of interest: Authors declared no conflict of interest.

Source of funding: None.

Licence: This work is licensed under a *Creative Commons Attribution-NonCommercial 4.0 International License*.

Double blinded peer review history:
Submission complete: November 20, 2023
Review began: November 13, 2023
Revision received: November 29, 2023
Revision accepted: February 22, 2024

REFERENCES

1. Hamel OL, Ahmed SA. Effectiveness of an educational program on nurses' knowledge and practices regarding nursing interventions of chest tube drainage system in Ibn Alnafees Teaching Hospital. J Educ Ethic Nurs. 2020;11(2):851.
2. Deilamy I, Amini M, Abbasi HR, Bolandparvaz S, Paydar S. Impact of peer-assisted learning in chest tube insertion education on surgical residents. J Surg Educ Exp. 2022;10(2):83.
3. Choi J, Villarreal J, Andersen W, Min JG, Touponse G, Wong C, et al. Scoping review of traumatic hemothorax: evidence and knowledge gaps, from diagnosis to chest tube removal. J Trauma Nurs. 2021;170(4):1260-7.
4. AL-gabri M, Mohammed MA, Mehany MM. Assessment of nurses' performance regarding care of chest trauma patients at trauma emergency unit. Assiut Sci Nurs J. 2019;7(17):121-32.
5. Arafa A, Abusaad F, Said DJ. Effectiveness of an educational program regarding care of infants with chest tube on nurses' knowledge and practice. Mansoura Nurs J. 2022;9(1):251-9.
6. Anderson D, Chen SA, Godoy LA, Brown LM, Cooke DT. Comprehensive review of chest tube management: a review. JAMA Surg. 2022;157(3):269-74.
7. Bertoglio P, Guerrera F, Viti A, Terzi AC, Ruffini E, Lyberis P, et al. Chest drain and thoracotomy for chest trauma. J Thoracic Dis. 2019;11(Suppl 2):S1
8. Kouser S, Ali A, Yaqoob A. Effect of chest drain management guidelines on knowledge and practice among nurses at Services Hospital: chest drain management guideli nes on knowledge among nurses. Pak J Health Sci. 2023;4(1):99-103.
9. Li Q, Jiang Y, Ding J, Li H, Zhang W, Chen H, et al. Chest tube-free video-assisted thoracoscopic surgery secured by quantitative air leak monitoring: a case series. J Thoracic Dis. 2023;15(1):146.
10. Asciak R, Bedawi EO, Bhatnagar R, Clive AO, Hassan M, Lloyd H, et al. British thoracic Society Clinical Statement on pleural procedures. Thorax. 2023 Jul 1;78(Suppl 3):s43-68.
11. Anand R, Brooks SE, Puckett Y, Richmond RE, Ronaghan CA. Pneumopericardium resulting from blunt thoracic trauma. Cureus. 2020;12(11):e11625.
12. Jackson K, Kafi O, Bhullar DS, Scott J, Storey C, Hyatali S, et al. Complications after thoracocentesis and chest drain insertion: a single centre study from the North East of England. J Respirat. 2021;1(2):135-40.
13. Elfaki B, Elbashir H, Ahmed A. Nurses' knowledge and practice regard care of patient with chest drains in Sudan Heart Center, Khartoum, Sudan. Nurs Health Sci. 2016;5:PP01-PP06.
14. AL-Gabri MM, Mohammed MA, Mehany MM. Factors affecting nurses compliance regarding the care of patients with chest trauma. J Adv Nurs. 2020;8(20.00):157-66.
15. Wallen MA, Morrison AL, Gillies D, O'Riordan E, Bridge C, Stoddart F. Mediastinal chest drain clearance for cardiac surgery. Cochrane Database Syst Rev. 2004;2002(4):CD003042.
16. Dango S, Sienel W, Passlick B, Stremmel C. Impact of chest tube clearance on postoperative morbidity after thoracotomy: results of a prospective, randomised trial. Eur J Cardiothorac Surg. 2010;37(1):51-5.
17. Zhao Z, Zhang T, Yin X, Zhao J, Li X, Zhou Y. Update on the diagnosis and treatment of tracheal and bronchial injury. J Thorac Dis. 2017;9(1):E50-E56.
18. Tarhan M, Akbaş Gökduman S, Ayan A, Dalar L. Nurses' Knowledge Levels of Chest Drain Management: A Descriptive Study. Eurasian J Pulmonol. 2016;18(3):153-9.
19. Hemberg J, Kaarre BM. The ethical demand as responsibility according to Logstrup-seen through the lens of a caring science tradition and in the context of meaning of caring. Int J Caring Sci. 2016;9(3):724-30.
20. Lu C, Jin YH, Gao W, Shi YX, Xia X, Sun WX, et al. Variation in nurse self-reported practice of managing chest tubes: A cross-sectional study. J Clin Nurs. 2018;27(5-6):e1013-e1021.
21. Ullah S, Naz N, Saeedullah NK, Rahman S, Sultan A. Assessment of nurse's knowledge regarding management of chest tube drainage at a public tertiary care hospital. Pak J Med Health Sci. 2022;16(10):31-4.
22. Tufail S, Ali A, Begum MF. Knowledge of Nurses Regarding Chest Drain Care at Public Tertiary Care Hospital Lahore. Saudi J Nurs Health Care. 2018;3:211-16.
23. Patidar D, Patidar K, Patel A. A study to assess the effectiveness of self-instructional module on knowledge about practice regarding management of patient with chest tube drainage among nurses working in selected hospitals of North Gujarat. Int J Nurs Educ Res. 2021;9(1):67-68.
24. Abdelazeem E, Fashafsheh I, Fadllalah H. Effect of training program on nurses knowledge and competence regarding endotracheal tube and tracheostomy care in mechanically ventilated patients. Int J Nurs. 2019;6(1):48-57.

Address for Correspondence:
Mr. Hamayat Ullah, Ziauddin University Faculty of Nursing and Midwifery Karachi Pakistan.
Email: hamayat.pk@gmail.com