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Systematic Review

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Blunt Chest Trauma and Chylothorax: A Systematic Review

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Introduction: Although traumatic chylothorax is predominantly associated with penetrating injuries, instances following blunt trauma, as a rare and challenging condition, are being increasingly documented. This study aims to systematically review the reported cases of blunt chest traumatic chylothorax (BCTC) and provide comprehensive insights into the condition.

Methods: Related studies published until December 11, 2024, were identified through Google Scholar. All studies documenting instances of BCTC, without restriction on cause or patient demographics, were included. Studies were excluded if they focused on chylothorax caused by penetrating injuries, their content was unretrievable, they were review articles, or they were published in blacklisted journals.

Results: Sixty-five eligible studies, encompassing 69 cases of BCTC, were included in the review. It predominantly affected males (73.91%), with patient ages ranging from 11 months to 84 years old. The most common clinical findings were dyspnea (47.83%) and abnormal auscultation or percussion (34.78%), with road traffic accidents as the primary cause (59.42%). Unilateral chylothorax was found in 72.46% of cases, bilateral chylothorax occurred in 27.54%, and pleural effusion was the most frequent radiological finding (55.07% in X-ray and 33.33% in computed tomography). Treatment typically included drainage (94.20%), parenteral nutrition (50.72%), and thoracic duct closure (39.13%). Most patients achieved complete recovery (89.85%), and six cases (8.70%) died.

Conclusion: The condition is rare and complex, underscored by the wide variability in patient demographics, clinical presentations, chylothorax onset, and management approaches. Given the challenges posed by limited evidence, the findings emphasize the need for early recognition and individualized management strategies.

Keywords: Blunt trauma, Chyle, Chylothorax, Chest trauma, Thoracic duct, Road traffic accident

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1. Introduction

Chylothorax is a rare condition characterized by the accumulation of chyle in the pleural cavity caused by a disruption of the thoracic duct [1]. Chyle is an opalescent fluid that consists of triglycerides, chylomicrons, proteins, electrolytes, immunoglobulins, and fat-soluble vitamins, transported from the gastrointestinal system into the bloodstream by the thoracic duct. It makes up about 1-3% of total body weight in adults. Chylothorax was initially described by Bartolet in 1633 and later reported in the literature by Quinke in 1875 [1,2]. It is categorized into congenital, neoplastic, traumatic, and miscellaneous forms. The most common cause is malignancy, which leads to obstruction of the thoracic duct, while traumatic chylothorax is typically iatrogenic, resulting from surgical procedures or catheter placement. Penetrating trauma is the usual cause of traumatic chylothorax, while blunt trauma is considered an infrequent cause [1,2]. It may also develop due to chest compression or changes in intrathoracic pressure, such as during coughing or persistent vomiting [2].

The incidence of chylothorax is about 0.2% following blunt thoracic trauma and 0.9% after penetrating trauma. Bilateral chylothorax resulting from blunt trauma, mainly when no other injuries are evident, is an infrequent but severe complication [3]. Without prompt treatment, chylothorax can lead to serious

complications, such as cardiopulmonary distress and significant nutritional deficiencies, with a high mortality rate of up to 15.5% [2-4]. Although traumatic chylothorax is predominantly associated with penetrating injuries, instances following blunt trauma have been increasingly documented, highlighting the need for awareness among healthcare providers regarding this potential complication [5,6]. This study aims to systematically review the reported cases of blunt chest traumatic chylothorax (BCTC) and provide comprehensive insights into the condition.

2. Methods

2.1. Literature search

The study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Related studies published until December 11, 2024, were identified through Google Scholar using a search strategy that combined the following keywords with the "allintitle" and "including citation" features: (blunt trauma chylothorax), (blunt thoracic trauma chylothorax), (blunt thoracic injury chylothorax), (blunt chest injury chylothorax), (blunt torso trauma chylothorax), (blunt thoracic duct trauma), (blunt thoracic duct injury) and (traumatic chylothorax). The search was limited to English-language publications.

2.2. Eligibility criteria

All studies or reports documenting instances of BCTC, without restriction on cause or patient demographics, were eligible for inclusion. Studies were excluded if they focused on chylothorax caused by factors other than blunt chest trauma, if their content was unretrievable, if they were review articles, or if they were published in blacklisted journals. The legitimacy of the studies was verified by cross-referencing with widely recognized predatory journal checklists [7].

2.3. Study selection

First, an author conducted a literature search using the specified keywords and collected the relevant results. The titles and abstracts of the identified studies were then screened to exclude duplicates, non-English studies, and those unrelated to the study objective. Full-text screening was conducted for studies that passed the initial filtration, excluding those with unretrievable content or irrelevant study designs, such as reviews. This step was supervised by two authors, who independently reviewed each study. Finally, the remaining studies underwent legitimacy filtering.

2.4. Data extraction

The collected data encompassed various parameters, including the first author's name, year of publication, patient demographics, clinical manifestations, causes of chylothorax, chyle volume and content, the onset of chyle production, diagnostic methods, ICU admission status, treatment modalities, outcomes, and follow-up.

2.5. Statistical Analysis

The extracted data were organized in an Excel sheet (2019) and analyzed descriptively using the Statistical Package for the Social Sciences (SPSS, v. 27, IBM Co.). The results were presented in frequencies with percentages, means with standard deviation, and ranges.

3. Results

3.1. Study identification

A systematic search yielded 201 studies, all of which were case reports. After removing duplicates (16) and non-English articles (17), 168 titles and abstracts were screened. Fifty-five case reports were excluded due to irrelevance, and full-text evaluation of the remaining 113 case reports led to the exclusion of an additional 42. Furthermore, six articles were excluded for being published in warning-listed journals. Consequently, 65 eligible case reports, encompassing 69 cases of BCTC, were included in the review [1-6,8-66] (Tables 1 and 2). The identification process is outlined in a PRISMA flowchart (Figure 1).

3.2. Presentation and etiology

The patients ranged in age from 11 months to 84 years, with a mean of 37.4 ± 19.9 years. Most cases were male (73.91%), while females accounted for 26.09%. The most common presenting symptom or clinical findings were dyspnea, observed in 47.83% of cases, followed by abnormal findings on auscultation or percussion (34.78%) and multiple fractures or injuries (27.54%). Other frequent symptoms included chest pain (21.74%) and pneumothorax, hemothorax, or hemopneumothorax (20.29%). Road traffic accidents (RTA) were the most prevalent cause of BCTC, accounting for 59.42% of cases, followed by falls (23.19%), trauma caused by heavy objects (8.70%), physical punishment or child abuse (4.34%), and fistfights (1.45%). Bilateral chylothorax was observed in 27.54% of cases, while 55.07% had right-sided involvement and 17.39% had left-sided involvement. The chyle leakage ranged widely, which was >1000–2000 mL/day in 40.58% of cases. Smaller volumes (<500 mL/day) were noted in 14.50% and 500 – 1000 mL/day in 20.28%. In 14.50% of cases, >2000 mL/day was drained. Chyle onset occurred within two days of presentation in 40.58% of cases and within three days to a week in 31.88%. Delayed onset (beyond one week) was reported in 13.04% of cases. The chyle predominantly contained only lipids (40.57%). Other compositions included lipid-protein mixtures (11.59%) and lipid-inflammatory cells (7.24%). Complex mixtures of lipids, proteins, sugars, inflammatory cells, and ions were seen in smaller proportions (5.80%) (Table 3).

3.3. Imaging characteristics and management

Chest X-rays revealed pleural effusion in 55.07% of cases, rib fractures, and lung or mediastinal or heart shift, each in 10.14%, lung opacification in 8.70%, and pneumothorax or hemothorax in 7.24%. Computed tomography (CT) scans confirmed pleural effusion in 33.33% and rib fractures in 20.29%. The vertebral fracture was found in 14.50%, and pneumothorax, hemothorax, or hemopneumothorax in 13.04%. Drainage was performed in 94.20%, predominantly via chest tubes (76.81%). In 17.39% of patients, the chest tube was in place for one week or less, while 15.94% required chest tube placement for more than one week until two weeks. Another 18.84% needed chest tube placement for over two weeks to one month, and 5.80% had chest tube placement exceeding one month. Additional treatments included parenteral nutrition (50.72%), thoracic duct closure (39.13%), and dietary modifications such as a medium-chain fatty acid or low-fat diet (34.78%). Pharmacological treatments included octreotide in 24.64% of cases. Thoracic duct closure was performed through thoracotomy in 31.88%. Other less-used techniques included Fr microcatheter under radiological guidance in 2.90%, video-assisted thoracoscopy or laparoscopy in 2.90%, and coiling and glue embolization in 1.45%. In 59.42% of cases, thoracic duct closure was not performed. The majority of patients (89.85%) achieved complete recovery, with one case showing partial recovery (1.45%), and six cases died (8.70%) (Table 3).

Table 1. Demography, cause of chylothorax, and chyle characteristics

First author, year [Reference]	Country	Age (year)	Gender	CFP	Cause	SOC	Amount of chyle (ml)/day*	COAP (day)	Biochemical content of chyle
Harvey, 2024 [5]	USA	60	F	Chest pain, multiple rib fractures	RTA	Left	<500	2	Triglycerides
Burduniuc, 2023 [2]	Czech Republic	70	F	Blunt injury	Fall on stairs	Right	>1000-2000	3	Protein, cholesterol, triglycerides
Dung, 2023 [14]	Vietnam	32	M	Thoracic spine injury, paraplegia	RTA	Right	>1000-2000	At once	Cholesterol, triglycerides
Kim, 2023 [4]	South Korea	45	M	Hemodynamically unstable, chest discomfort, multiple fractures, hemopneumothorax	Crushed by a 2-ton metal frame	Left	>1000-2000	1.66	Triglycerides
Boateng, 2023 [33]	USA	75	F	Respiratory distress	Fall from bed	Right	<500	At once	Triglycerides
Ruest, 2023 [34]	USA	15 months	M	Tenderness over right paraspinal thoracolumbar back, abnormal auscultation	Child abuse	Right	N/A	At once	N/A
Mohanakrishnan, 2022 [35]	USA	70	F	Dyspnea, back pain, abnormal auscultation	Violent coughing episode	Right	>1000-2000	At once	Chylomicrons, triglycerides
Mazhar, 2021[23]	UK	42	F	Dyspnea, abnormal auscultation	Fall from horse 1 week before presentation	Right	>1000-2000	7	Triglycerides
Waseem, 2021[32]	Pakistan	50	M	Dyspnea	RTA 2 days before presentation	Bilateral	>1000-2000	2	Triglycerides, cholesterol, fat-rich fluid with few inflammatory cells
Din Dar, 2021 [36]	India	50	M	Blunt injury	RTA	Right	>1000-2000	25	Triglyceride, chylomicrons
Bacon, 2020 [9]	USA	53	M	Hemopneumothorax	RTA	Left	<500	5	N/A
Champion, 2020 [12]	Canada	29	M	Dyspnea, flushing, diaphoresis, vomiting, abnormal auscultation	RTA	Bilateral	>1000-2000	At once	Cholesterol, triglycerides
Jindal, 2019 [37]	India	35	M	Dyspnea, respiratory distress	RTA	Bilateral	>1000-2000	4	Triglyceride, WBC, albumin, glucose, protein, LDH
Ahmed, 2018 [1]	Iraq	42	M	Severe back pain	RTA	Right	500-1000	2	Triglycerides and lymphocytes
Brown, 2018 [10]	USA	53	M	Thoracoabdominal injuries, subcutaneous emphysema, unstable pelvis	RTA	Left	>1000-2000	N/A	Triglycerides and lymphocytes
Litzau, 2018 [22]	USA	66	F	Dyspnea, multiple fractures, abnormal auscultation	RTA 7 days before presentation	Right	>1000-2000	7	Triglycerides
Kozul, 2017 [19]	Australia	18	M	Multiple injuries	RTA	Bilateral	500-1000	0.46	N/A
Lee, 2017 [21]	South Korea	70	M	Hemothorax, flail chest	RTA	Right	>2000	5	Triglycerides, cholesterol
Mohamed, 2017 [3]	USA	51	M	Dyspnea, chest pain, abnormal auscultation	Fall on stairs	Bilateral	>1000-2000	5	Triglycerides, Leukocytes, RBCs, LDH, protein
Spasić, 2017 [6]	Serbia	55	F	Multiple injuries	RTA	Right	>2000	5	N/A
Sriprasit, 2017 [31]	Thailand	27	F	Hemothorax, neurogenic shock, multiple fractures	RTA	Left	<500	5	Triglycerides, protein, glucose, LDH

Table 1. Continued…

First author, year [Reference]	Country	Age (year)	Gender	CFP	Cause	SOC	Amount of chyle (ml)/day*	COAP (day)	Biochemical content of chyle
Hara, 2017 [38]	Japan	17	F	Breathing difficulty, abnormal percussion	Recurrent chylothorax, physical punishment	Left	500-1000	At once	N/A
Jahn, 2017 [39]	Germany	8	F	Respiratory distress, abnormal percussion, and auscultation	Pedestrian hit by a motor vehicle	Left	<500	5	Protein, albumin, LDH, triglycerides, cholesterol
Ghodrati, 2016 [40]	Iran	12	F	Dyspnea, respiratory distress	Chest trauma during play at school	Bilateral	N/A	N/A	N/A
Lee, 2016 [41]	South Korea	50	M	Paraplegia	Fall from height during construction work	Right	>1000-2000	3	Triglycerides
Sendama, 2015 [42]	UK	84	F	Dyspnea, abnormal auscultation	Fall	Right	500-1000	4	Protein, LDH, cholesterol, triglycerides
Snow, 2015 [43]	USA	22 months	M	Cough, dyspnea, respiratory distress, altered mental status, abnormal auscultation	Fall from a chair	Right	<500	2	Triglycerides
Adams, 2013 [44]	USA	73	M	Paraplegia, rib fractures, hemothorax	RTA	Right	N/A	9	Triglycerides, lymphocytes, glucose, LDH, lipemia
Kumar, 2013 [45]	India	32	M	Blunt injury, fracture of right femur	RTA	Right	>1000-2000	2	Triglycerides, chylomicrons
		23	M	Hemopneumothorax, multiple rib fractures, subcutaneous emphysema	RTA	Right	500-1000	1	Triglycerides
		40	M	Hemothorax	RTA	Right	500-1000	2	Triglycerides
Sharkey, 2012 [46]	UK	50	M	Multiple fractures, hematoma, hemothorax, pneumothorax	RTA	Right	500-1000	N/A	Triglyceride, cholesterol
Sokouti, 2011[30]	Iran	15	M	Respiratory distress, dyspnea, back pain, abnormal auscultation	Fall 11 years ago	Bilateral	>2000	40	Triglycerides, protein, cholesterol, fat
Kurklinsky, 2011 [47]	USA	26	F	Pleuritic chest pain	Water-skiing fall	Bilateral	>1000-2000	2	Triglycerides

Table 1. Continued…

First author, year [Reference]	Country	Age (year)	Gender	CFP	Cause	SOC	Amount of chyle (ml)/day*	COAP (day)	Biochemical content of chyle
Apostolakis, 2009 [8]	USA	75	F	Dyspnea, back pain	RTA	Bilateral	500-1000	At once	Protein, LDH, glucose, amylase, triglycerides, cholesterol, albumin, globulin, K, Na, lymphocytes, erythrocytes
		22	M	Back pain, hematoma of left thigh, chest pain	RTA	Bilateral	<500	0.25	Protein, LDH, glucose, amylase, triglycerides, cholesterol, albumin, globulin, K, Na, lymphocytes, erythrocytes
Huber, 2009 [16]	USA	47	M	Dyspnea, chest pain	Crushed by multiple metal gates	Bilateral	500-1000	3	Triglycerides
Schurz, 2009 [28]	Austria	39	M	Dyspnea, thoracodorsal pain	RTA	Left	>1000-2000	14	N/A
Serin-Ezer, 2009 [29]	Turkey	4	M	Dyspnea, somnolence, abnormal auscultation	Hit by a manufacturing pipe falling from a truck	Bilateral	<500	At once	Triglycerides, cholesterol, protein, LDH, glucose
Kamiyoshihara, 2008 [18]	Japan	51	M	Dyspnea, dullness in percussion	RTA 20 years before presentation	Bilateral	>1000-2000	At once (but the trauma dated back to 20 years prior)	Triglycerides
Pandey, 2008 [48]	Australia	36	M	Chest pain, flail chest, hypotension	Fall from balcony	Right	>1000-2000	2	N/A
Lee, 2006 [20]	South Korea	11	M	Dyspnea, nausea, vomiting, abdominal discomfort, abnormal auscultation	RTA 3 days before presentation	Bilateral	N/A	3	Triglycerides, cholesterol, protein
Ozcelik, 2004 [26]	Turkey	15	F	Respiratory distress, subcutaneous emphysema, pneumothorax	Trapping under rubble during a 7.8 magnitude earthquake	Right	N/A	45	Cholesterol, triglycerides
Robbins, 2004 [49]	USA	41	M	Chest injury, refractory hiccups, nausea	RTA	Bilateral	N/A	N/A	N/A
Buchan, 2001 [50]	UK	18	M	Dyspnea	RTA	Right	>1000-2000	4	N/A
Chamberlain, 2000 [11]	UK	29	M	Pneumothorax, abdominal and paraspinal pain, loss of motor power, and sensation below T12/L1	RTA	Right	>1000-2000	0.88	N/A

Table 1. Continued…

First author, year [Reference]	Country	Age (year)	Gender	CFP	Cause	SOC	Amount of chyle (ml)/day*	COAP (day)	Biochemical content of chyle
Glyn-Jones, 2000 [51]	UK	28	M	Dyspnea, polytrauma, tachypnea	RTA	Left	>2000	N/A	Triglyceride, cholesterol, WBC
Golden, 1999 [15]	USA	53	F	Chest pain, multiple fractures, hemopneumothorax, abnormal auscultation	RTA	Left	>2000	6	Triglycerides
McCormick, 1999 [24]	USA	46	M	Chest pain, dyspnea, abnormal auscultation, dullness to percussion	Hit-and-run motor vehicle accident	Bilateral	>1000-2000	14	Protein, cholesterol, triglycerides
Ikonomidis, 1997 [17]	Canada	17	M	Closed head injury, multiple fractures, respiratory distress, tracheal hematoma	RTA	Bilateral	<500	At once	Triglycerides
		24	M	Closed head injury, rib fractures, hemothorax	Snowboarding accident	Left	<500	At once	Triglycerides
Guleserian, 1996 [52]	USA	11 months	M	Dyspnea, coughing, cold symptoms, grunting, abnormal percussion	Child abuse	Right	500-1000	N/A	Triglycerides, cholesterol, WBC
Milano, 1994 [25]	Italy	26	F	Dyspnea	Fall while skiing 4 months prior	Left	>1000-2000	50	Triglycerides
Fogli, 1993 [53]	Italy	31	M	Suspected traumatic hemothorax, dyspnea, cough	RTA	Right	500-1000	N/A	N/A
Grant, 1991 [54]	New Zealand	32	M	Dyspnea, chest and back pain	RTA	Right	>1000-2000	N/A	N/A
Dulchavsky, 1988 [13]	USA	48	M	Dyspnea, chest pain, abnormal auscultation	Fistfight	Right	>1000-2000	At once	Cholesterol, HDL, triglycerides, pre-beta lipoprotein, chylomicrons
Brook, 1988 [55]	USA	27	M	Respiratory distress, abnormal percussion, tachycardia	RTA	Bilateral	>2000	3	Triglycerides
Pai, 1984 [27]	USA	19	M	Neck, back, and chest pain	RTA	Right	>1000-2000	N/A	N/A
Krishnan, 1982 [56]	Malaysia	29	M	Dyspnea, abnormal percussion	RTA	Right	>2000	2	N/A
Azambuja, 1981 [57]	Brazil	42	M	Paraplegia, hemopneumothorax	RTA	Right	N/A	3	N/A
Rea, 1960 [58]	UK	28	M	Dyspnea, apex beat displaced to the left	Crush injury from falling planks	Right	500-1000	4	Lipid, protein, RBC, lymphocytes
Guest, 1955 [59]	Canada	19	M	Dyspnea, dry cough, tachypnea, dull percussion	RTA	Right	>1000-2000	26	N/A
Elliot, 1948 [60]	Canada	56	M	Fall injury, paraplegia, respiratory distress	Fall from a tree	Right	500-1000	3	Fat
Dorsey, 1942 [61]	USA	60	M	Alcoholic stupor, dyspnea, chest pain, abnormal percussion	Fall down a flight of stairs	Right	>2000	0.5	Protein, albumin, globulin, fat

Table 1. Continued…

First author, year [Reference]	Country	Age (year)	Gender	CFP	Cause	SOC	Amount of chyle (ml)/day*	COAP (day)	Biochemical content of chyle
Cellan-Jones, 1940 [62]	UK	32	M	Dyspnea, chest tightness	A stone hitting the chest and dorsal spine striking a block of coal	Right	>1000-2000	3	Fat
Brown, 1937 [63]	USA	N/A	F	Respiratory distress, abdominal distention	RTA	Bilateral	>1000-2000	At once	N/A
Bauersfeld, 1937 [64]	USA	22	M	Breathing difficulty, laceration of the scalp, pain in lower abdomen and lumbar region, cyanosis, cold extremities	RTA	Right	>2000	8	Fat globules
Lillie, 1935 [65]	USA	45	M	Blunt injury	Fall from a scaffold 20 feet high	Right	>2000	N/A	N/A
Macnab, 1932 [66]	Canada	46	M	Chest and back pain, dullness percussion, dyspnea, anorexia, weakness, intermittent fever, hypotension	Fall from a height of 11 feet	Right	500-1000	6	N/A

***F**: female, **M**: male, **CFP**: clinical findings & presentation, **SOC**: Side of chylothorax, **N/A**: non-available, **COAP**: Chyle onset after presentation, **RTA**: road traffic accident, **RBC**: red blood cell, **LDH**: lactate dehydrogenase, **HDL**: high density lipoprotein, **WBC**: white blood cell. * The amount of chyle has been grouped rather than the actual amount.*

Table 2. Imaging findings, treatment and outcomes.

First author, year [Reference]	Chest X-ray	CT	MRI	ICU admission	Treatment	Thoracic duct ligation approach	Mode of drainage	Duration of chest tube placement (day)	Follow-up (weeks)	Outcome
Harvey, 2024 [5]	Pleural effusion	Hemopneumothorax, pneumomediastinum, retrosternal hematoma, multiple rib fracture, lung contusions, and manubrium fractures	N/A	Yes	Drainage, medium chain fatty acid diet	N/A	Chest tube	7	8	Recovered
Burduniuc, 2023 [2]	Pleural effusion, multiple rip fracture	Pleural effusion, multiple rib fracture	Th12 vertebral fracture	Yes	Drainage, thoracic duct ligation	Thoracotomy	Chest tube	N/A	N/A	Recovered
Dung, 2023 [14]	Pleural effusion	T9 and T10 vertebral fracture	N/A	No	Drainage, octreotide, TPN, thoracic duct embolization	2.7 Fr microcatheter, fluoroscopic guidance	Chest tube	7	N/A	Recovered

Table 2. Continued…

First author, year [Reference]	Chest X-ray	CT	MRI	ICU admission	Treatment	Thoracic duct ligation approach	Mode of drainage	Duration of chest tube placement (day)	Follow-up (weeks)	Outcome
Kim, 2023 [4]	Pleural effusion	Lipiodol leakage near T10–11 level	N/A	Yes	Drainage, TPN, intranodal lymphangiography, therapeutic lipiodol injection	N/A	Chest tube	39	N/A	Recovered
Boateng, 2023 [33]	N/A	Pleural effusion, lung collapse	N/A	No	Drainage, medium-chain triglyceride	N/A	Chest tube	N/A	N/A	Died
Ruest, 2023 [34]	Pleural effusion	T12 vertebral body fracture, rib fractures	N/A	Yes	Drainage	N/A	Chest tube	N/A	N/A	Recovered
Mohanakrishnan, 2022 [35]	N/A	Pleural effusion, minimal ascites	N/A	No	Drainage, octreotide, low-fat diet, NPO, TPN, pleurodesis, thoracic duct embolization	Coiling and glue embolization	Chest tube	N/A	N/A	Recovered
Mazhar, 2021[23]	Pleural effusion	Pleural effusion, T10 spinous process fracture	N/A	No	Drainage, octreotide, medium-chain triglyceride diet	N/A	Chest tube	3	N/A	Recovered
Waseem, 2021[32]	Pleural effusion	Pleural effusion	N/A	No	Only drainage	N/A	Chest tube	5	N/A	Recovered
Din Dar, 2021 [36]	N/A	Multiple rib fractures, hemothorax	N/A	No	Drainage, NPO, TPN, octreotide, thoracic duct embolization	Thoracotomy	Chest tube	25	48	Recovered
Bacon, 2020 [9]	Multiple rib fracture	Multiple rib fracture	N/A	Yes	Drainage, free-fat diet	N/A	Chest tube	N/A	12	Recovered
Champion, 2020 [12]	Pleural effusion	Pleural effusion	N/A	No	Drainage, octreotide, TPN, thoracic duct ligation	Thoracotomy	Chest tube	N/A	6	Recovered
Jindal, 2019 [37]	Pleural effusion	Multiple rib fractures, lung contusions, fracture of L1 and L2 vertebrae	N/A	Yes	Drainage, thoracic duct ligation, TPN, octreotide, fat-free and medium chain triglyceride	Thoracotomy	Chest tube	8	8	Recovered
Ahmed, 2018 [1]	Opacification of hemithorax	D10 vertebral fracture, multiple rib fracture	N/A	Yes	Drainage, low-fat diet, albumin vial, octreotide	N/A	Chest tube	14	8	Recovered

Table 2. Continued…

First author, year [Reference]	Chest X-ray	CT	MRI	ICU admission	Treatment	Thoracic duct ligation approach	Mode of drainage	Duration of chest tube placement (day)	Follow-up (weeks)	Outcome
Brown, 2018 [10]	N/A	Left temporal epidural hematoma, pulmonary contusions, multiple skeletal fractures, pneumomediastinum compressing the right atrium	Not mentioned the findings	No	Drainage, NPO, TPN, octreotide, thoracic duct embolization, and ligation	Thoracotomy, decortication	Chest tube	N/A	24	Recovered
Litzau, 2018 [22]	Pleural effusion	Pleural effusion	N/A	No	Drainage, low-fat diet	N/A	Chest tube	9	N/A	Recovered
Kozul, 2017 [19]	N/A	Hemopneumothorax, mediastinal shift to the right, pleural effusion	N/A	No	Drainage, no fat/low-fat diet	N/A	Chest tube	7	4	Recovered
Lee, 2017 [21]	Pleural effusion	Multiple rib fractures, hemopneumothorax (left), subcutaneous emphysema (left), and atelectasis (right).	N/A	Yes	Drainage, TPN, NPO, fat-free diet, medium-chain lipid diet, thoracic duct ligation, pleurectomy	Thoracotomy	Chest tube	14	48	Recovered
Mohamed, 2017 [3]	Obliteration of left costophrenic angle (pleural effusion)	Bilateral effusion	N/A	No	Drainage, fat-free diet with medium-chain triglycerides, octreotide	N/A	Thoracentesis	N/A	3	Recovered
Spasić, 2017 [6]	Lung contusion	Rib and thoracic vertebral fracture, hydropneumothorax, lung contusion, pneumomediastinum	N/A	No	Drainage, TPN, thoracic duct suturing	Thoracotomy	Chest tube	25	N/A	Recovered
Sriprasit, 2017 [31]	N/A	N/A	N/A	Yes	Drainage, NPO, TPN	N/A	Chest tube	17	N/A	Recovered
Hara, 2017 [38]	Pleural effusion	N/A	N/A	No	Drainage, low-fat diet with medium-chain triglycerides, intranodal lymphangiography with lipiodol	N/A	Chest tube	30	76	Recovered
Jahn, 2017 [39]	Pulmonary opacification	Lung contusions	N/A	No	Drainage, fat-free diet	N/A	Chest tube	20	N/A	Recovered
Ghodrati, 2016 [40]	Pleural effusion	N/A	N/A	Yes	Drainage, thoracic duct embolization	Unknown	Chest tube	N/A	N/A	Recovered

Table 2. Continued…

First author, year [Reference]	Chest X-ray	CT	MRI	ICU admission	Treatment	Thoracic duct ligation approach	Mode of drainage	Duration of chest tube placement (day)	Follow-up (weeks)	Outcome
Lee, 2016 [41]	N/A	Incomplete cord injury at the thoracic spinal vertebrae (T10 and T11)	N/A	No	Drainage, TPN, NPO, thoracic duct ligation	VATS	Chest tube	N/A	N/A	Recovered
Sendama, 2015 [42]	Pleural effusion	Multisegment fracture of L1 vertebra	N/A	No	Drainage, medium chain fatty acid diet, octreotide	N/A	Chest tube	N/A	N/A	Died due to infection, deteriorated condition
Snow, 2015 [43]	Opacification of right chest, mediastinal shift to left	N/A	N/A	Yes	Drainage, NPO, TPN, octreotide, low-fat diet	N/A	Chest tube	37	N/A	Recovered
Adams, 2013 [44]	Pleural effusion, atelectasis	Pleural effusion, atelectasis	N/A	Yes	Drainage, NPO, TPN, octreotide	N/A	Thoracentesis, chest tube	17	N/A	Recovered
Kumar, 2013 [45]	N/A	Pleural effusion, multiple rib fractures	N/A	No	Drainage, NPO, TPN, octreotide, chest physiotherapy	N/A	Chest tube	8	N/A	Recovered
	N/A	Hemopneumothorax, multiple rib fractures	N/A	No	Drainage, NPO, TPN, octreotide, chest physiotherapy	N/A	Chest tube	6	N/A	Recovered
	N/A	Bilateral hemothorax, lung contusion	N/A	Yes	Drainage, NPO, TPN, octreotide, exploratory laparotomy for biliary leak	N/A	Chest tube	9	N/A	Recovered
Sharkey, 2012 [46]	N/A	N/A	N/A	Yes	Drainage, NPO, TPN, octreotide, medium fatty acid diet	N/A	Chest tube	N/A	N/A	Recovered
Sokouti, 2011[30]	Large cystic mass in left posterior mediastinum	Large low-density cystic mass in the left posterior mediastinum, left pleural effusion	N/A	No	Drainage, thoracic duct ligation, TPN	Laparotomy, Thoracotomy	Chest tube	N/A	48	Recovered
Kurklinsky, 2011 [47]	N/A	Pleural effusion, dilated cisterna chyli, middle mediastinum fluid collection	N/A	No	Drainage, TPN, thoracic duct embolization	3 Fr microcatheter with ultrasound guidance	Thoracentesis	5	N/A	Recovered

Table 2. Continued…

First author, year [Reference]	Chest X-ray	CT	MRI	ICU admission	Treatment	Thoracic duct ligation approach	Mode of drainage	Duration of chest tube placement (day)	Follow-up (weeks)	Outcome
Apostolakis, 2009 [8]	Pleural effusion	Pleural effusion	N/A	No	Drainage, starvation diet, TPN	N/A	Chest tube	21	N/A	Recovered
	Pleural effusion, rib fractures, ipsilateral sternoclavicular joint dislocation	Lung contusion	N/A	No	Drainage, starvation diet, TPN	N/A	Chest tube	13	N/A	Recovered
Huber, 2009 [16]	Pleural effusion	Pleural effusion, right pneumothorax, multiple rib fracture, aortic pseudoaneurysm, retrocrural hemorrhage	N/A	Yes	Drainage, thoracic duct ligation, medium chain fatty acid diet, mechanical pleurodesis	Thoracotomy	Chest tube	3	N/A	Recovered
Schurz, 2009 [28]	Multiple rib fracture, pleural effusion	Pleural effusion	Osseous lesions and pleural effusion	Yes	Drainage, TPN, fat-free diet, plain tea, apple puree	N/A	Pleural puncture, chest tube	11	N/A	Recovered
Serin-Ezer, 2009 [29]	Multiple rib fracture, pleural effusion	Pleural effusion	N/A	No	Drainage, NPO, TPN	N/A	Chest tube	7	24	Recovered
Kamiyoshihara, 2008 [18]	Pleural effusion	Pleural effusion	N/A	No	Drainage, low-fat diet, TPN, thoracic duct ligation, pleurodesis	Thoracotomy	Thoracentesis, Chest tube	100	36	Recovered
Pandey, 2008 [48]	N/A	Hemopneumothorax, pulmonary contusion, multiple rib fractures, pneumomediastinum	N/A	Yes	Drainage, octreotide, thoracic duct ligation	Laparoscopic ligation	Chest tube	7	N/A	Recovered
Lee, 2006 [20]	Elevation of diaphragms, cardiomegaly	Pleural effusion, massive ascites around liver and spleen	N/A	No	Drainage, medium-chain lipid solution, NPO	N/A	Thoracentesis, chest tube	N/A	N/A	Partially recovered
Ozcelik, 2004 [26]	Pneumothorax, consolidated right lung, pleural effusion	Right lung consolidation, pleural effusion	N/A	No	Drainage, thoracic duct mass ligation, TPN	Thoracotomy	Chest tube	20	4	Recovered
Robbins, 2004 [49]	N/A	Pleural effusion, focal fluid collection	N/A	No	EUS-guided aspiration, injection of sodium morrhuate	N/A	Aspiration	N/A	N/A	Recovered
Buchan, 2001 [50]	Pleural effusion	N/A	N/A	No	Drainage, low-fat diet, medium-chain triglycerides, thoracic duct ligation	Thoracotomy	Chest tube	11	32	Recovered

Table 2. Continued…

First author, year [Reference]	Chest X-ray	CT	MRI	ICU admission	Treatment	Thoracic duct ligation approach	Mode of drainage	Duration of chest tube placement (day)	Follow-up (weeks)	Outcome
Chamberlain, 2000 [11]	Pneumothorax, hemithorax opacification	Free abdominal gas	Fractures of T4 and T10 with spinal cord contusion and hematoma	No	Drainage, TPN, NPO, Supradiaphragmatic duct ligation	Thoracotomy	Chest tube	N/A	N/A	Recovered
Glyn-Jones, 2000 [51]	Mediastinal shift	Minor anterior wedge fractures at T5 and T10	Cord injury at T10	No	Drainage, thoracic duct ligation, pleurodesis, fat-free diet	Thoracotomy	Chest tube	N/A	6	Recovered
Golden, 1999 [15]	N/A	N/A	N/A	Yes	Drainage, TPN, NPO, thoracic duct ligation	Thoracotomy	Chest tube	12	N/A	Recovered
McCormick, 1999 [24]	Pleural effusion	Disruption of the thoracic duct at the T5 level	N/A	No	Only drainage	N/A	Chest tube	N/A	N/A	Recovered
Ikonomidis, 1997 [17]	Pneumomediastinum, pulmonary contusions	N/A	N/A	No	Drainage, TPN, bowel rest	N/A	Chest tube	17	2	Recovered
	Left hemothorax	Left mediastinal hematoma, T3 vertebral fracture	N/A	No	Drainage, TPN, bowel rest	N/A	Chest tube	19	4	Recovered
Guleserian, 1996 [52]	Right lung opacification and mediastinal shift to left	N/A	N/A	No	Drainage, nasogastric feeding with medium-chain triglycerides, low-fat diet	N/A	Chest tube	7	N/A	Recovered
Milano, 1994 [25]	Pleural effusion	Dense lymphatic opacification at L1-L2, chyloma at D11, pleural leakage from left duct	N/A	No	Drainage, low-fat diet, medium-chain triglycerides, TPN, pleuroperitoneal shunt	N/A	Thoracentesis	N/A	96	Recovered
Fogli, 1993 [53]	Pleural effusion, mediastinal shift	N/A	N/A	No	Drainage, TPN	N/A	Chest tube	16	24	Recovered
Grant, 1991 [54]	Pleural effusion	N/A	N/A	No	Drainage, thoracic duct ligation, TPN, low-fat diet	Thoracotomy	Thoracocentesis, chest tube	N/A	N/A	Recovered
Dulchavsky, 1988 [13]	Pleural effusion	N/A	N/A	No	Drainage, TPN, NPO, thoracic duct ligation	Thoracotomy	Chest tube	N/A	144	Recovered
Brook, 1988 [55]	Pleural effusion	N/A	N/A	Yes	Drainage, NPO, TPN, low-fat/ high-protein diet	N/A	Chest tube	10	32	Recovered

Table 2. Continued…

First author, year [Reference]	Chest X-ray	CT	MRI	ICU admission	Treatment	Thoracic duct ligation approach	Mode of drainage	Duration of chest tube placement (day)	Follow-up (weeks)	Outcome
Pai, 1984 [27]	Fracture dislocations of C6-C7 and T11-T12, right hemothorax	N/A	N/A	No	Drainage, fat-free diet, TPN, thoracic duct ligation, parietal pleurectomy	Thoracotomy	Chest tube	N/A	N/A	Recovered
Krishnan, 1982 [56]	Pleural effusion, obliteration of left costophrenic angle, multiple rib fractures	N/A	N/A	No	Drainage, thoracic duct ligation	Thoracotomy	Chest tube	19	5	Recovered
Azambuja, 1981 [57]	Hemopneumothorax	N/A	N/A	No	Drainage, thoracic duct ligation, pleural flap to address fistula, pleural abrasion	Thoracotomy	Chest tube	6	N/A	Recovered
Rea, 1960 [58]	Opaque hemithorax	N/A	N/A	No	Drainage, thoracic duct ligation	Thoracotomy	Chest tube	N/A	N/A	Recovered
Guest, 1955 [59]	N/A	N/A	N/A	No	Aspiration, high-protein, low-fat diet	N/A	Thoracentesis	N/A	4	Recovered
Elliot, 1948 [60]	Pleural effusion	N/A	N/A	No	Aspiration, thoracic duct ligation	Thoracotomy	Aspiration	N/A	N/A	Recovered
Dorsey, 1942 [61]	Rib fracture, pleural effusion	N/A	N/A	No	Drainage, low-fat diet, high-carb, high-protein diet, NPO	N/A	Thoracentesis	N/A	N/A	Died due to uncontrolled leakage
Cellan-Jones, 1940 [62]	Pleural effusion	N/A	N/A	No	Aspiration, low-fat diet, intravenous glucose-saline	N/A	Aspiration	N/A	N/A	Died due to uncontrolled leakage
Brown, 1937 [63]	Pleural effusion	N/A	N/A	No	Drainage, dietary management	N/A	Thoracentesis, paracentesis	N/A	N/A	Died
Bauersfeld, 1937 [64]	Pleural effusion, mediastinal shift	N/A	N/A	No	Drainage, intravenous dextrose, high-calorie diet	N/A	Thoracentesis	16	N/A	Recovered
Lillie, 1935 [65]	Pleural effusion, mediastinal displacement	N/A	N/A	No	Drainage, fat-free diet	N/A	Thoracentesis	N/A	N/A	Recovered
Macnab, 1932 [66]	Displacement of the heart, pleural effusion	N/A	N/A	No	Drainage, carbohydrates, protein	N/A	Aspiration	48	2	Died due to extreme asthenia

***CT**: computed tomography, **MRI**: magnetic resonance imaging, **ICU**: intensive care unit, **NPO**: Nulla Per Os, **TPN**: total parenteral nutrition, **N/A**: non-available, **EUS**: endoscopic ultrasound*

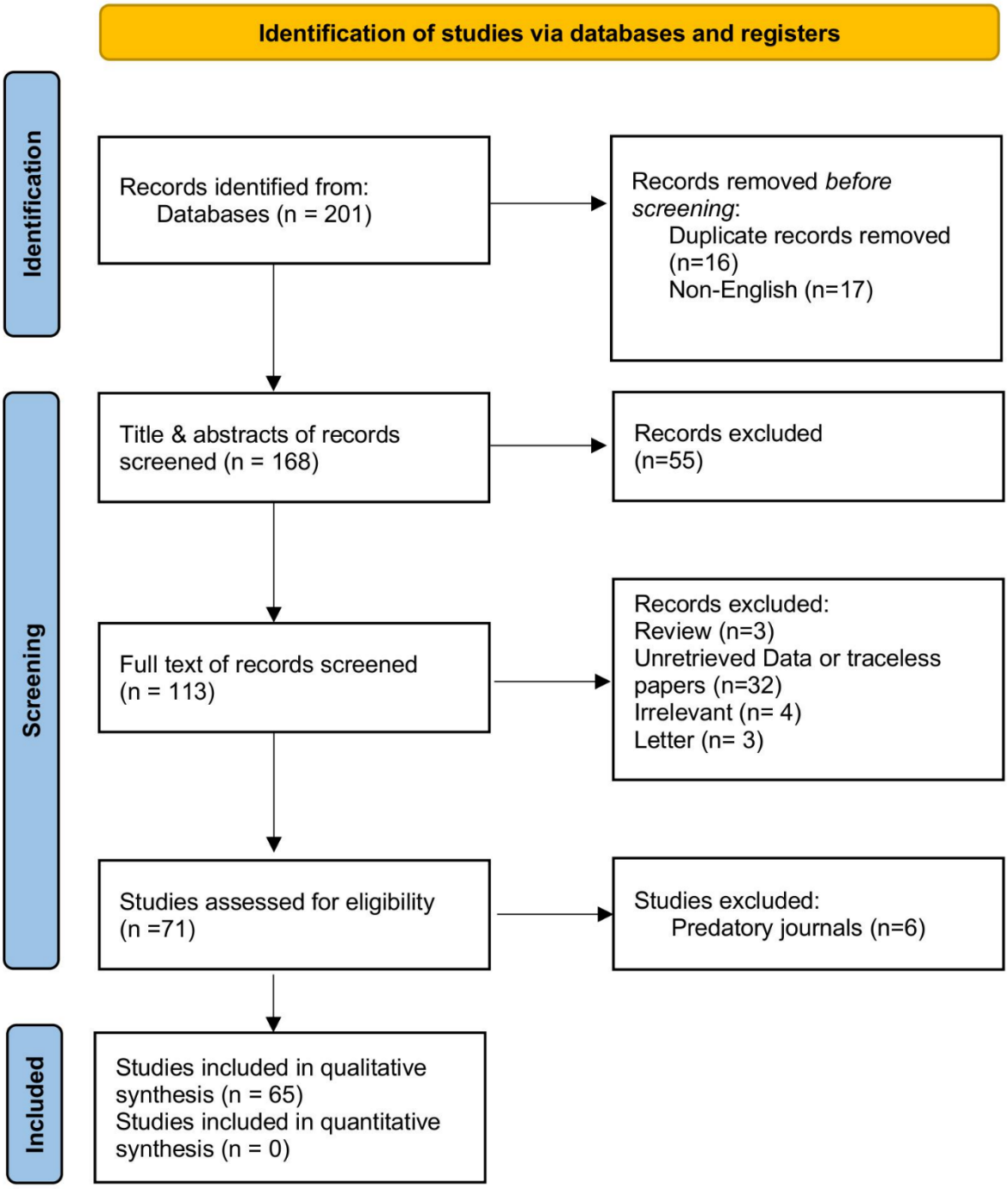

Figure 1. Study selection PRISMA flow chart.

Table 3. Summary of findings of the reviewed cases.

Variables	Frequency / Percentage
Patient demography	
Age range (mean ± SD), years	11 months – 84 (37.4 ± 19.9)
Gender	
Male	51 (73.91%)
Female	18 (26.09%)
Common presentation and clinical findings*	
Dyspnea	33 (47.83%)
Abnormal auscultation or percussion	24 (34.78%)
Multiple fractures or injuries	19 (27.54%)
Chest pain	15 (21.74%)
Pneumothorax/ hemothorax/ hemopneumothorax	14 (20.29%)
Back pain	11 (15.94%)
Respiratory distress	11 (15.94%)
Cause of blunt trauma	
Road traffic accident	41 (59.42%)
Fall	16 (23.19%)
Hit or crushed by heavy objects	6 (8.70%)
Physical punishment & child abuse	3 (4.34%)
Fistfight	1 (1.45%)
Others	2 (2.90%)
Side of chylothorax	
Right	38 (55.07%)
Left	12 (17.39%)
Bilateral	19 (27.54%)
Amount of chyle (ml/day)	
<500	10 (14.50%)
500 - 1000	14 (20.28%)
>1000-2000	28 (40.58%)
>2000	10 (14.50%)
N/A	7 (10.14%)
Chyle onset after presentation (day)	
At once – 2 days	28 (40.58%)
3 days – one week	22 (31.88%)
> one week – one month	6 (8.70%)
> one month	3 (4.34%)
N/A	10 (14.50%)
Biochemical content of chyle	
Lipid	28 (40.57%)
Lipid + Protein	8 (11.59%)
Lipid + Inflammatory cells	5 (7.24%)
Lipid + Protein + Sugar + Inflammatory cells + Ions	4 (5.80%)
Lipid + Protein + Sugar	2 (2.90%)
Lipid + Inflammatory cells + Protein	2 (2.90%)
N/A	20 (29.00%)
Imaging findings	
Chest X-rays*	
Pleural effusion	38 (55.07%)
Rib Fracture	7 (10.14%)
Lung/ mediastinal/ heart shift	7 (10.14%)
Opacification of lung	6 (8.70%)
Pneumothorax/ hemothorax	5 (7.24%)
Lung contusion	2 (2.90%)
Pneumomediastinum	1 (1.45%)
Vertebral fracture	1 (1.45%)
Lung consolidation	1 (1.45%)
Others	5 (7.24%)
N/A	15 (21.74%)
CT scan findings*	
Pleural effusion	23 (33.33%)
Rib fracture	14 (20.29%)
Vertebral fracture	10 (14.50%)
Pneumothorax/ hemothorax/ hemopneumothorax	9 (13.04%)
Lung contusion	8 (11.59%)
Pneumomediastinum	4 (5.80%)
Hematoma	3 (4.34%)
Thoracic duct leakage	2 (2.90%)
Others	17 (24.64%)
N/A	25 (36.23%)
ICU admission	
Yes	19 (27.54%)
No	50 (72.46%)

Table 3. Continued…

Variables	Frequency / Percentage
Common treatment approach*	
Drainage	65 (94.20%)
Parenteral nutrition	35 (50.72%)
Thoracic duct ligation/embolization/suturing	27 (39.13%)
Medium-chain fatty acid or low-fat diet	24 (34.78%)
Nulla per Os	19 (27.54%)
Free fat diet/starvation diet	12 (17.39%)
Octreotide	17 (24.64%)
Pleurectomy/Pleurodesis	6 (8.70%)
Thoracic duct closure approach	
Thoracotomy	22 (31.88%)
Fr microcatheter with fluoroscopic/ ultrasound guidance	2 (2.90%)
VATS/ laparoscopy	2 (2.90%)
Coiling and glue embolization	1 (1.45%)
Unknown	1 (1.45%)
Not performed	41 (59.42%)
Mode of drainage	
Chest tube	53 (76.81%)
Thoracentesis	9 (13.04%)
Aspiration	4 (5.80%)
Chest tube + Thoracentesis	3 (4.34%)
Duration of chest tube placement	
≤ One week	12 (17.39%)
> One week – two weeks	11 (15.94%)
> Two weeks – one month	13 (18.84%)
> One month	4 (5.80%)
N/A	29 (42.03%)
Outcome	
Recovered	62 (89.85%)
Partially recovered	1 (1.45%)
Died	6 (8.70%)

***SD**: standard deviation, **CT**: computed tomography, **ICU**: intensive care unit, **VATS**: video-assisted thoracoscopic surgery, **N/A**: non-available*

**Each data in the variable might be found in more than one case*

4. Discussion

Chylothorax is a pathological condition; if left untreated, it can result in respiratory distress and various complications. The etiology is multifaceted, including traumatic causes, while non-traumatic factors may involve conditions that elevate lymphatic pressure or cause obstruction, such as lymphoma or heart failure [1,67]. Chylothorax was first documented in the medical literature during the 19th century but has since garnered increasing recognition with advancements in diagnostic and surgical techniques. Improved imaging modalities and surgical innovations have significantly enhanced the understanding of its pathophysiology, facilitating more effective identification and management of its underlying causes [1,2].

The demographic data in the present review revealed an age range of 11 months to 84 years, with a mean age of 37.4 ± 19.9 years. This aligns with the literature, as Elsaied et al. reported an approximate mean age of 42.67 years within an age range of 18 to 76 years [68]. Case reports have identified young adults as particularly susceptible to chylothorax following blunt chest trauma, who are commonly involved in motor vehicle collisions or sports injuries [12,31]. Conversely, another study found that individuals aged 50 years or older represented the most common age group among blunt chest trauma patients, comprising 28.9% of the sample [69]. This reflects the increased risk of falls and accidents among older populations [70]. The slightly lower mean age in the present study may be attributable to the inclusion of pediatric cases, broadening the demographic scope. A significant male predominance was observed in the current review, with 73.91% of cases involving males. This finding concurs with the literature, where male representation ranged from 72.3% in a literature review [71] to 85.4% in a cohort study on blunt chest trauma cases [69]. This gender disparity is often linked to higher exposure to high-risk activities and occupations among males [12,31].

The clinical presentation of chylothorax is variable, with dyspnea being the most common symptom, reported by approximately 66.7% of patients. Dyspnea arises from fluid accumulation in the pleural space, which restricts lung expansion and impairs gas exchange. Patients may also experience a dry cough, often exacerbated by pleural fluid [72]. Pleuritic chest pain is another potential symptom, likely caused by pleural irritation from chyle [3,5]. On physical examination, percussion of the thorax often reveals dullness over the affected area due to fluid accumulation, contrasting with the typical resonance of healthy lung tissue [3,12,22]. Auscultation typically shows diminished or absent breath sounds over regions where fluid has accumulated, reflecting impaired air movement [72]. In this review, consistent with the literature, dyspnea was the most common presenting symptom (47.83%). This was followed by abnormal findings on auscultation or percussion in 34.78% of cases. Other frequently reported symptoms included chest pain (21.74%) and complications such as pneumothorax, hemothorax, or hemopneumothorax (20.29%).

The thoracic duct, the primary conduit for lymphatic fluid, can be ruptured or injured by blunt trauma, leading to chyle leakage into the pleural space [71,73]. Damage to adjacent structures, such as vertebral fractures or mediastinal injuries, can also contribute to chylothorax. For example, thoracic spine injuries have been associated with chylothorax due to their anatomical proximity to the thoracic duct [4,14]. Chylothorax is predominantly unilateral. In a study of 74 cases, 78% involved one hemithorax, with the right side being affected in 67% and the left in 33%. Bilateral pleural effusion was observed in 22% of cases [74]. The volume of chyle leakage varies based on the severity of the injury and the extent of thoracic duct damage. Low-output chylothorax (<1000 mL/day) is typically managed conservatively, whereas high-output cases (>1–1.5 L/day) often require surgical or radiological intervention [4,37,75]. In extreme cases, chyle output exceeding 2000 mL/day has been reported [6,15,21,30]. Blunt chest trauma frequently results from RTA, underscoring the risks of high-speed collisions [5,22,32]. Falls

are another common cause, accounting for approximately 45% of cases in a study of patients with multiple traumas [76]. In this review, RTA was found to be the leading cause of injury in 41 cases (59.42%), followed by falls in 16 cases (23.19%), trauma by heavy objects in 6 cases (8.70%), physical punishment or child abuse in three cases (4.34%) and fistfights in one case (1.45%). Bilateral chylothorax occurred in 27.54% of cases, higher than previously reported. Consistent with the literature, right-sided involvement (55.07%) was more common than left-sided involvement (17.39%). This finding contrasts with the observation of Kakamad et al., who reported no laterality difference, but is similar to the findings of Maldonado et al., who reported right-sided involvement in 67% of cases and left-sided involvement in 33% [71,74]. Chyle volume varied significantly, with 40.58% of cases producing >1000–2000 mL/day, while 10 cases (14.50%) exceeded 2000 mL/day.

The timing of chyle onset in this review varied, with symptoms developing within two days in 40.58% of cases and within three days to a week in 31.88%. These align with the finding that chylothorax most commonly manifests within 2 to 7 days following blunt chest trauma due to gradual pleural accumulation from duct leakage [71]. However, delayed onset beyond one month, as observed in 4.34% of reviewed cases, is rare but documented in the literature, with an extreme case reported up to 20 years post-trauma [18]. The biochemical composition of chyle among the reviewed cases primarily consisted of lipids (40.57%), with smaller proportions of lipid-protein mixtures (11.59%) and lipid-inflammatory cell mixtures (7.24%). Complex mixtures, including lipids, proteins, sugars, inflammatory cells, and ions, were identified in 5.80% of cases. These findings are consistent with the established biochemical profile of chyle, which is rich in triglycerides (≥110 mg/dL) and lymphocytes [71]. As reported in the literature, immunoglobulins and protein levels ranging from 2.2 to 6 g/dL underscore the nutritional and immunological impact of chyle loss [1,8,32].

In the present review, chest X-rays revealed pleural effusion in 55.07% of cases, consistent with its status as the most common radiographic finding in chylothorax, typically presenting as a homogeneous opacity [2,4,32,71]. Rib fractures and lung or mediastinal or heart shift each were observed in 10.14% of cases, with lung opacification in 8.70% and pneumothorax, or hemothorax in 7.24%, aligning with literature that highlights the utility of chest X-rays in detecting associated traumatic injuries, such as rib fractures and pulmonary contusions [2,6,77]. CT scans in the reviewed cases showed pleural effusion in 33.33% of cases and rib fractures in 20.29%. The detection of pneumothorax, hemothorax, or hemopneumothorax in 13.04% of cases further emphasizes the role of CT in visualizing coexisting traumatic injuries with greater detail than X-rays [4,77].

The initial approach to managing chylothorax primarily involves conservative measures, including nil per os (nothing by mouth), total parenteral nutrition, and adherence to a low-fat diet. Pharmacological interventions, such as octreotide, may decrease lymphatic flow and facilitate the closure of the leak [10,14,21,23]. In chylothorax management, chest tube placement is commonly maintained until chyle drainage significantly decreases or resolves. The duration varies from a few days to several weeks, influenced by the effectiveness of conservative approaches [78]. In this review, the chest tube was in place for one week or less in 17.39% of patients, while 15.94% required chest tube placement for more than one week until two weeks. Another 18.84% needed chest tube placement for over two weeks to one month, and 5.80% had chest tube placement exceeding one month.

In cases where conservative management proves ineffective, surgical intervention becomes imperative. Thoracic duct ligation remains the definitive surgical option and can be performed via open thoracotomy or minimally invasive approaches [79]. Based on the findings of this review, besides drainage, treatments for chylothorax included parenteral nutrition (50.72%), thoracic duct closure (39.13%), and dietary modifications, such as a medium-chain fatty acid or low-fat diet (34.78%). Octreotide was administered in 24.64% of cases. Thoracic duct closure was performed via thoracotomy in 31.88% of cases, Fr microcatheter with fluoroscopic/ ultrasound guidance in 2.90%, VATS or laparoscopy in 2.90%, and coiling and glue embolization in 1.45%. In 59.42% of cases, thoracic duct closure was not performed or was unnecessary.

The limitations of this study include the inherent nature of the reviewed studies, which were exclusively case reports due to the rarity of the condition. Consequently, drawing conclusions based on statistical analyses was not feasible. Additionally, the small sample size and the non-standardized data reporting across the included reports may have introduced potential bias into the findings of this review. While every effort was made to include all relevant studies identified through the search using predefined keywords, there remains the possibility that some studies were inadvertently overlooked.

5. Conclusion

BCTC is rare and complex, underscored by the wide variability in patient demographics, clinical presentations, chylothorax onset, and management approaches. Given the challenges posed by limited evidence, the findings emphasize the need for early recognition and individualized management strategies.

Declarations

Conflicts of interest: The authors have no conflicts of interest to disclose.

Ethical approval: Not applicable.

Consent for participation: Not applicable.

Consent for publication: Not applicable.

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Authors' contributions: FHK, and HOA: Major contributors to the conception of the study, as well as the literature search for related studies, and manuscript writing. HKA, BJHA, and HMA: Literature review, critical revision of the manuscript, and processing of the tables. SHM, BeAA, SMA, MNH, SSA, YMM, KAN, SHK and BaAA: Data extraction, data organization, and critical revision. All authors have read and approved the final version of the manuscript.

Use of AI: ChatGPT-3.5 was used to assist with language refinement and improve the overall clarity of the manuscript. All content was thoroughly reviewed and approved by the authors, who bear full responsibility for the final version.

Data availability statement: Not applicable.

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