Supplementary materials

Table 1. Summary of studies included.

Author/year/country	Study design	Objective	Key findings
Santus et al. 2023; Italy[7]	Narrative clinical review	Summarise acute dyspnoea pathophysiology and the role of LUS for early diagnosis/management.	Early recognition of respiratory failure is critical; LUS shows high diagnostic accuracy and sensitivity for acute dyspnoea syndromes.
Schoeneck et al., 2021; USA[4]	Observational study	To assess feasibility and diagnostic performance of pre-hospital thoracic ultrasound (B-lines) for dyspnoea , particularly AHF.	Prehospital B-line assessment by trained paramedics is feasible and yields high sensitivity/specificity for AHF.
Arvig et al., 2023; Denmark[8]	Randomised controlled trial (RCT)	To determine whether serial cardiopulmonary POCUS plus usual care reduces acute dyspnoea severity vs usual care alone.	Serial POCUS with usual care significantly reduces dyspnoea severity, supporting routine use for faster stabilisation.

Beyer et al., 2021; USA[9]	Prospective multicentre cohort	To evaluate whether POCUS reduces diagnostic uncertainty in dyspnoeic patients when performed by emergency physicians without a dedicated ultrasound team.	POCUS provides immediate diagnostic information, narrows differentials, and is effective even without a specialised ultrasound team.
Kowalczyk et al., 2023; Poland[10]	Review	To review LUS techniques/protocols and its utility for differential diagnosis of dyspnoea.	LUS demonstrates high sensitivity/specificity for dyspnoeaaetiologies and is suitable for pre-hospital use to enable early, targeted treatment.
Zare et al., 2022; Irann[11]	Randomised controlled trial	To evaluate the effectiveness of bedside thoracic ultrasound by emergency physicians for undifferentiated acute dyspnoea.	Early thoracic ultrasound in the ED increases diagnostic accuracy and reduces turnaround time.
Farahmand et al., 2020; Iran[12]	Diagnostic accuracy study	To compare cardiac, thoracic, and inferior vena cava (IVC) ultrasound—alone or combined—for acute decompensated heart failure.	The combination of thoracic, cardiac, and IVC ultrasound yields high diagnostic accuracy for acute decompensated heart failure.
Kok et al., 2022; Netherlands[13]	Review	To assess effectiveness/efficiency of POCUS for	POCUS improves diagnostic accuracy in dyspnoea, non-

		respiratory and circulatory emergencies.	traumatic hypotension, and shock, accelerating treatment; more feasible/rapid than alternative imaging in acute settings.
Glöckner et al., 2020; Germany[14]	Prospective single-centre study	To evaluate POCUS accuracy (B-lines) for diagnosis and short-term monitoring in acute dyspnoea due to AHF.	LUS is useful for early AHF diagnosis but has limited value for exclusion; minimal change observed at 24–72 h monitoring.
Nakao et al., 2021; Canada[15]	Cohort study	To compare diagnostic accuracy of LUS vs chest radiography for AHF in dyspnoeic ED patients.	LUS by emergency physicians shows high sensitivity (~92.5%) and good specificity, outperforming chest radiography (~63.6%).
Bouzidi et al., 2025; Tunisia[16]	Review	To evaluate accuracy of LUS combined with clinical assessment vs traditional diagnostic pathways for AHF in ED dyspnoea.	LUS is excellent for ruling in/out AHF; systematic use is recommended in ED pathways.
Ienghong et al., 2024; Thailand[17]	Cross-sectional study	To determine characteristics and diagnostic accuracy of prehospital ultrasound using portable devices.	Prehospital POCUS can be implemented effectively; field diagnoses correlate well with in-hospital diagnoses.
Fitzgerald et al., 2024; USA[18]	Prospective pre–post study	To test whether a brief thoracic POCUS	Focused paramedic education for

		training improves pre-hospital diagnostic accuracy and treatment plans for COPD/AHF exacerbations.	undifferentiated respiratory distress and thoracic ultrasound interpretation improves treatment planning.
Vauthier et al., 2021; France[19]	Prospective study	To assess LUS utility for AHF diagnosis and evaluate a POCUS-based algorithm in acute dyspnoea.	In 103 adults, POCUS LUS and its algorithm perform excellently for acute dyspnoea evaluation.
Gundersen et al., 2023; Denmark[20]	Prospective observational study	To examine whether POCUS improves diagnostic accuracy for dyspnoea aetiologies (including AHF), given that uncertainty relates to worse outcomes.	Supplemental pre-hospital POCUS improves overall diagnostic accuracy; sensitivity remains modest, but tailored use optimises rule-in/rule-out for AHF.
Russel et al., 2024; USA[21]	Prospective non-randomised interventional study	To compare paramedic diagnostic accuracy for AHF with vs without LUS in prehospital dyspnoea, and assess impact on therapy initiation.	LUS improves pre-hospital AHF sensitivity/accuracy and increases rates while reducing time to initiation of AHF therapy.