Communication in critical care tracheostomy patients dependent upon cuff inflation: a scoping review

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Review paper

Communication in critical care tracheostomy patients dependent upon cuff inflation: A scoping review

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ABSTRACT

Objectives: The aim of this study was to synthesise the evidence concerning communication in critically ill tracheostomy patients dependent on cuff inflation. The aim was to identify the psychological impact on patients awake and alert with tracheostomies but unable to speak; strategies utilised to enable communication and facilitators and barriers for the success of these strategies.
Review method used: This scoping review was conducted using the Joanna Briggs Institute framework and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews.
Data sources: CINAHL, Embase, Medline, and Web of Science were searched from 1st January 2000 to 30th September 2023 and supplemented with hand searching of references from included studies.
Review methods: Studies were eligible if they addressed the psychological impact of voicelessness and/or the structure, process, and outcomes of augmentative and alternative communication (AAC) systems, in addition to facilitators and barriers to effectiveness. The population of interest included critically ill tracheostomy patients dependent on cuff inflation, their families, and healthcare workers. Screening and data extraction were undertaken by two reviewers independently. Data analysis involved descriptive statistics and content analysis.
Results: A total of 23 studies met the inclusion criteria: 11 were qualitative, nine were quantitative, and three were mixed-methods studies. Voicelessness elicited negative emotions, predominantly frustration. AAC systems, encompassing unaided and aided (low-tech and high-tech) methods, presented both advantages and drawbacks. High-tech strategies held promise for patients with physical limitations. Patients equally appreciated the support offered through unaided strategies, including eye contact and touch. Facilitating factors included speech therapy involvement and assessment. Patient-related challenges were the most frequent barriers.
Conclusion: Facilitating meaningful communication for critically ill tracheostomy patients dependent on cuff inflation is of paramount psychological significance. Whilst AAC systems are practicable, they are not without limitations, implying the absence of a universally applicable solution. This underscores the importance of continuous evaluation, reinforced by a multidisciplinary team.
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1. Background

Tracheostomy insertion is typically preferable for patients requiring an artificial airway for a protracted length of time.[1] This choice is underpinned by numerous advantages, including enhanced success in the transition from mechanical ventilation

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(MV), increased patient comfort, and a reduced need for sedation.[2] Nevertheless, a paradox unfolds within this scenario: the potential for enhanced communication, aided by decrease in sedation, remains elusive for those patients dependent upon an inflated tracheostomy cuff.

Effective communication is a crucial component to meet many patient needs including information giving, expression of symptoms and emotions, and to allow participation in decision-making.[3–6] For critically ill patients with an artificial airway, effective communication is defined as the degree to which a patient can initiate, impart, receive, and understand information. This may range from ineffective to effective exchanges of basic to complex information between patient and communication partners.[7]

The impact of being rendered suddenly voiceless has been described as one of the most stressful events of critical care admission,[8–10] particularly exacerbated by COVID-19-pandemic-related visitation restrictions and use of personal protective equipment.[11] Importantly, emotional distress experienced during critical care is a predictor of negative psychological outcomes during recovery such as anxiety,[12,13] depression,[14,15] post-traumatic stress disorder,[16,17] and intrusive and delusional memories.[18–20]

Restoration of the patient's own voice is the ideal communication option[21] and numerous methods, including one-way speaking valves (SVs), have been shown to produce phonation.[22–24] However, SVs necessitate cuff deflation (itself reliant on cough strength and bulbar function, especially spontaneous saliva swallow function),[25] and sufficient clinical stability, particularly in terms of ventilatory requirements. Therefore, timing of cuff deflation varies depending upon the patient's condition.[26]

Augmentative and alternative communication (AAC) systems are a range of tools, technologies, and/or approaches to help people with communication impairments in speech and/or language.[27] Augmentative communication is to add to someone's speech, whilst alternative refers to using instead of speech. AAC systems are further categorised into unaided or aided (low and high technology), with selection varying across settings.[28] The empirical evidence on AAC systems for patients with artificial airways including those completely ventilator-dependent and reliant on cuff inflation has previously been reported.[29–34] However, these reviews do not differentiate between endotracheal tube (ETT) or tracheostomy-tube patients, the latter of whom are known to experience a complex care pathway with prolonged hospital stays.[35] More recent reviews on patients with tracheostomies have focussed on overall management (with no specific focus on communication)[36] or concentrated solely on patient and nurse perspectives of communication.[37]

1.1. Review questions

The main review question was 'What is the extent and nature of the available literature related to communication in adult critically ill tracheostomy patients dependent on cuff inflation'?' The sub-questions were as follows:

(i) What is the psychological impact on patients with tracheostomies being awake and alert but unable to speak?
(ii) What strategies (aids, assessment, and management policies) are currently being used to enable communication in critically ill tracheostomised patients dependent upon cuff inflation and how successful are they?
(iii) What are the facilitators and barriers for the success of these strategies?

2. Methods

Following the framework advocated by the Joanna Briggs Institute,[38] the review process was organised into five distinct stages: (i) identification of review questions; (ii) definition of eligibility criteria, concepts of interest, and context; (iii) identification of search strategy; (iv) study selection and data extraction process; and (v) collation, summary, and reporting of findings. A protocol for the study was developed *a priori* and published on Open Science Framework Registries (available at: http://osf.io/y6fkw)[39] This scoping review was reported in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews checklist.[40] Consistent with recommendations from Arksey and O'Malley,[41] the review was developed collaboratively with lay stakeholders to strengthen its value and applicability. Stakeholders included five individuals from intensive care unit steps, a UK-wide charity: four were former patients who had undergone tracheostomy, and one was a family member. Stakeholders were consulted via online meetings to discuss their perspectives on communication with a tracheostomy and to ensure the inclusion of relevant objectives for the review.

3. Study eligibility

This review included empirical research studies that reported qualitative research (interviews, observation methods) and quantitative research (survey, observational, randomised, and non-randomised studies). Further eligibility criteria were defined using the Population–Concept–Context mnemonic to structure the search strategy.[42] (Table 1).

3.1. Search strategy and information sources

Search strategies were developed in consultation with a health science librarian to identify all types of publications relating to communication in critical care tracheostomised patients. CINAHL, EMBASE, Medline, and Web of Science databases were searched from 1st January 2000 to 30th September 2023. A starting date of 2000 was selected to reflect the paradigm shift to minimal critical care sedation practices, enabling patients to be more awake. Each search query was constructed to the specific requirements of each database with truncated and Boolean operators utilised as appropriate (Supplementary File 1). Manual searching of bibliographies and reference lists was also conducted.

3.2. Selection of evidence

Citations were downloaded to Endnote 20.1 (2020). Deduplication and removal of nonrelevant search results was conducted (CMC). Two independent reviewers (CMC and BC) screened titles, abstracts, and full texts for assessment against the inclusion criteria. Disagreements were resolved through discussion or with an additional reviewer (BB).

3.3. Data charting process and analysis

A qualitative data analysis approach consisting of the simultaneous processes of data reduction, display, and conclusion drawing and verification was undertaken. Data were extracted onto a data extraction form by three independent reviewers (CMC, LMI, and AA) (Supplementary File 2). Extracted data included study characteristics (type of study, population, concept and context, study aim, year of publication, and main findings). Data were stored on a

Table 1
Scoping review eligibility criteria.

Component	Inclusion	Exclusion
Population	Adult critical care patients with cuffed tracheostomies: awake and alert Communication partners (i.e., nursing, medical, and allied healthcare professionals and family members)	Tracheostomy inserted before critical care admission Long-term tracheostomy Studies focussed solely on endotracheal patients or studies, in which less than 75% of patients had a tracheostomy
Concept	Psychological impact of voicelessness Structure, process, and/or outcomes of communication strategies (unaided, low-tech, or high-tech aids) Stakeholders' satisfaction, facilitators, and barriers to communication and communication strategies	
Context	All countries and all adult critical care settings (intensive care and high-dependency units of all specialities)	Studies before 2000
Type of studies	Empirical studies written in English language (not including systematic reviews or other review methodology)	Discussion and commentary papers

secure university server. Corroboration and legitimisation of extracted data was performed by cross-checking of data extraction tables by both reviewers. Disagreements were settled through discussion within the team. Consistent with scoping review methodology, a formal assessment of studies for quality or risk of bias was not conducted. Extracted data were content analysed (CMC), and key themes were identified. Results reported included a descriptive numerical summary of included studies and a narrative summary of the themes identified through content analysis.[38]

4. Results

4.1. Selection of sources of evidence

The search strategy identified 1006 records: 191 records were screened for eligibility at full text, and 23 papers were included in analysis. The most common reason for excluding papers was the inability to distinguish data belonging to patients with endotracheal and tracheostomy tubes (Supplementary File 3). The flowchart of the screening process is illustrated in Fig. 1.

4.2. Characteristics of sources of evidence

The studies used various designs: 11 were qualitative (48%), nine were quantitative (39%), and three were mixed-methods (13%) studies. The prospective observational study design accounted for five quantitative studies, and there was one randomised controlled trial. Qualitative studies included five case studies/reports, four phenomenological studies, and two interview narrative studies. Sixteen papers evaluated a single or combined AAC system.[43–57,65] Of the remaining seven papers,[58–64] the focus was on the lived experience of having a tracheostomy tube, including communication interactions between patients and nurses.[62,64] Studies were conducted in nine different countries, with seven (30%) being published in the USA. From the papers published between 2000 and 2023, 16 (70%) were published since 2015. Table 2 provides detailed characteristics of each study. Fig. 2 outlines the themes and subthemes emerging from this review.

4.3. Psychological impact of sudden voicelessness

Six papers (27%) reported the psychological impact of impaired communication as their main concept of interest.[58–61,63,64] Primarily qualitative in design, these studies provided a rich source of insight into the lived experience with tracheostomised patients describing a spectrum of challenging emotions when rendered suddenly voiceless. Frustration was the most frequently cited emotion,[58,59,61,63] but frustration could quickly manifest as anger.[60,61,63] Anxiety,[59] panic,[59] and isolation[61,63] were also expressed. In the mixed-methods study by Freeman et al.,[61] the visual analogue scale of self-esteem[66] was used, with findings indicating that absence of voice was associated with lower mood and reduced quality of life. Participants reported their lowest self-esteem scores at the baseline (i.e., before regaining their voice). However, there was a positive change in self-esteem scores upon the return of voice, with statistically significant improvements observed between the baseline and the return of voice in five categories: feeling misunderstood, cheerful, mixed-up, angry, and trapped.

Psychological impact was also measured and reported by four papers that evaluated AAC systems.[50,53,56,57] Through the utilisation of predefined scales incorporated into eye-tracking systems, participants reported moderate levels of sadness, accompanied by prevalent sentiments of feeling trapped and frustrated,[56,57] yet the application of AAC systems also served to emphasise how negative emotions may be alleviated. The introduction of the electrolarynx[53] led to a significant decrease in anxiety levels. Utilising the Faces Anxiety Scale,[67] a single-item scale with five possible responses (where neutral is scored as 1 and extreme distress as 5), a median (IQR) reduction in anxiety scores from 3.8 (2.8–5.0) before the electrolarynx was introduced to 2.0 (1.0–2.0) upon the completion of intelligibility and comprehensibility testing ($P = 0.007$) was reported. Similarly, quality of life – mechanical ventilation scores were significantly higher among patients who used a Portex Blueline Ultra Suctionaid (BLUSA) talking tracheostomy tube than among patients who did not use BLUSA or an SV ($P = 0.04$).[50]

Given the nature of critical illness, attempts to communicate required a great amount of physical and mental effort on the patient's part,[63] yet the nonvocal communication experience was frequently characterised by misinterpretation.[52,63] Patients described how staff misinterpreted and incorrectly vocalised what they thought patients said.[60] Lack of communication success served to compound feelings of helplessness and hopelessness.[59,63] To a lesser extent, the impact of communication failure was reported from a staff perspective. Tolotti et al.[63] described nurses as experiencing incompetence and despair and utilising avoidance strategies to evade communication difficulties.

Furthermore, voicelessness limited patients' abilities to comprehend what was happening and inhibited their participation in care.[61,63] One participant succinctly summed up the stress of being unable to speak as, 'it drove me nuts'.[58] Voice represented much more than a means of communication. To have speech taken away equated to the removal of part of a person's identity.[60] Loss of voice symbolised a significant challenge to an individual's self-concept and how they were represented to the outside world.[58] With the sudden absence of voice, patients experienced feelings

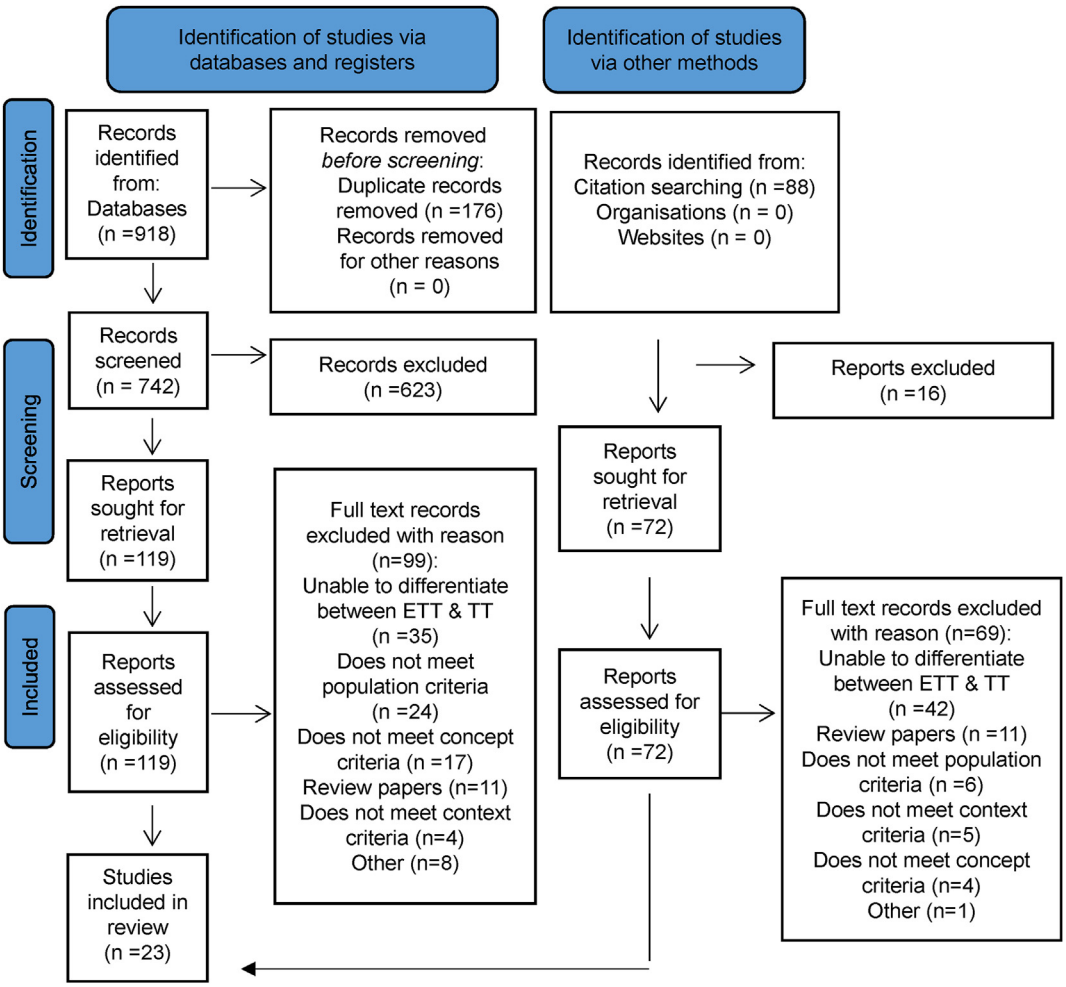

Fig. 1. PRISMA flowchart. Abbreviation: PRISMA = Preferred reporting items for systematic reviews and meta-analyses.

of dehumanisation.[52] Participants recalled feelings of invisibility and that without a voice, they counted for nothing.[63]

4.4. AAC systems

Sixteen papers (70%) focussed on various AAC systems as their main concept of interest. Among these, 12 studies investigated specific communication devices: tracheostomy tubes enabling voice with cuff inflation ($n = 6$),[45–47,49–51] electronic AAC systems ($n = 5$),[44,55–57,65] and the electrolarynx device ($n = 1$).[53] These devices were primarily evaluated in patients who were alert, orientated, and engaged in nonverbal communication attempts. One paper presented a case study on lipreading,[48] and three papers discussed a combination of AAC systems incorporating unaided or low-tech interventions.[43,52,54]

Five papers evaluated high-tech AAC systems, involving a total of 121 participants. Study designs included two observational studies, two pilot studies, and one qualitative study. Among these, three studies investigated eye-gaze technology, a system utilising infrared light sources to capture users' eye movements, with complex algorithms processing this data to allow patients to indicate responses by directing their gaze towards corresponding regions on the screen.[55–57] In a pilot study by Ull,[55] it was demonstrated that, despite initial challenges, including labour intensity, voiceless intensive care unit patients successfully adopted eye-tracking technology within a relatively brief period. The main outcomes from the prospective observational studies[56,57] highlighted that the eye-gaze technology empowered patients to convey their pain, quality of life, and mood by utilising predefined scales. Two additional studies addressed high-tech strategies with a shared emphasis on tablet-based applications.[44,65] In the case of OnScreen Communicator,[44] a software programme featuring an alphabet board, picture boards, and the technological advantage of word prediction, results revealed a diversity of patient perspectives. Some participants reported it as valuable, whereas others considered it unnecessary in specific situations. A pilot study examined a speech-recognition application that utilised novel technology to analyse patients' lip movements.[65] Albeit small (n = 14), the pilot demonstrated a promising correlation between mouthed phrases and app recognition. Nevertheless, the study highlighted several challenges related to both patient and environmental factors. Variations in illumination, including facial shadows, as well as the presence of medical equipment such as nasogastric tubes, were shown to impact the accuracy of the application.

Among the six types of tracheostomy tubes currently available that enable voice with cuff inflation, only the Blom®[45,51] and the BLUSA tube[46,47,49,50] were appraised in the six included studies involving a total of 82 patients. All the studies consistently reported the feasibility of using such tubes to facilitate phonation in critically ill patients dependent upon cuff inflation.

Table 2
Summary table of included articles in scoping review.

First Author, Year	Aim	Design	Setting	Participants	Main concept of interest
Qualitative Studies					
Happ 2010[43]	To describe weekly communication case conferences led by SLPs as part of the wider SPEACS-2 communication skills training intervention.	Case study	One neurological ICU and one trauma ICU, USA	3 patients *Inclusion/exclusion criteria:* None stated	Communication Intervention: SPEACS-2 programme: - 6 self-learning modules using video exemplars of target skills; - Communication assessment algorithm to reinforce assessment and decision-making steps in choosing and applying AAC strategies or requesting speech language consultation; - Communication materials supplied in a 'communication cart'. - Weekly SLP communication case conferences
Holm 2018[44]	To evaluate a communication tool for conscious, MV critical care patients	Phenomenological approach using semistructured interviews and observations.	Two ICUs in Aarhus University Hospital, Denmark	7 patients; 25 nurses *Inclusion criteria (patients):* ≥17 years; spoke Danish; on invasive ventilation and had a TT or ETT; RASS score between −1 and + 1 to ensure consciousness. *Exclusion criteria (patients)*: Unable to give consent for participation or due to ethical considerations.	Communication Intervention: - Onscreen Communicator—a software programme downloaded onto tablets - Accompanying communication book identical to the software programme
Meltzer 2012[48]	To present a case report on lip-reading interpreters for MV patients capable of mouthing words.	Case report	Burns unit of a university teaching hospital, New York, USA	1 patient *Inclusion/exclusion criteria:* None stated	Communication Intervention: Combination of a deaf lip-reading interpreter and a hearing sign language interpreter.
Pryor 2016[51]	To examine patterns of initial and ongoing voice restoration with the Blom tracheostomy tube speech cannula.	Case report	One ICU in a tertiary hospital, Australia	3 patients *Inclusion criteria:* Ventilator-dependent with tetraplegia following cervical spinal cord injury; ≥7 days post insertion of cuffed TT and still required both cuff inflation and MV; MV would continue for ≥48 h post enrolment; approval from medical team to change from initial TT to Blom® TTS; English-speaking; demonstrating sufficient alertness, orientation, and nonverbal communication attempts via mouthing. *Exclusion criteria:* Any upper or lower airway obstruction; anatomy requiring an extended length tube; copious and/or tenacious secretions; and/or respiratory requirements exceeding PEEP ≥10 or fraction of inspired oxygen (FiO2) ≥ 0.6.	Communication Intervention: Blom Talking Tracheostomy Tube

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Table 2 (*continued*)

First Author, Year	Aim	Design	Setting	Participants	Main concept of interest
Radtke 2011[52]	To illustrate the use of SLP expertise and application of AAC strategies across different levels of illness severity and communication impairment for nonspeaking ICU patients.	Case report	USA	3 patients (cases were drawn from the SPEACS study and the acute-care speech-language consultation practice of one author). *Inclusion/exclusion criteria:* None stated	Communication Intervention: - Unaided AAC (e.g., mouthing words, yes/no questions); - Low-tech AAC (e.g., alphabet boards); - High-tech AAC (e.g., electronic speech-generating devices)
Scibilia 2022[54]	To present the experience of a team of hospital-based SLPs providing AAC support to ICU patients treated for COVID-19.	Case report	A tertiary care facility with 7 ICUs, Massachusetts, USA	3 patients *Inclusion/exclusion criteria:* None stated	Communication intervention: - Unaided AAC (e.g., mouthing words, yes/no questions, head nods); - Low-tech AAC (e.g., picture boards); - High-tech AAC (e.g., tablets)
Donnelly 2006[58]	To investigate the lived experience of a tracheostomy tube change.	Phenomenological approach using nonstructured interviews	One ICU of a large metropolitan acute care hospital, Australia	4 patients *Inclusion criteria:* Conscious and alert during TT change; no medications that may have dulled patients recollection of the procedure. *Exclusion criteria:* Patients who had suffered any level of neurological damage.	Impact of voicelessness on patients: - Frustration - Challenge to self-concept
Flinterud 2015[59]	To describe how tracheostomised patients experience communication.	Descriptive/Interpretive approach using semistructured interviews	One combined surveillance unit and ICU, Norway	11 patients *Inclusion criteria:* Tracheostomised for a minimum of 48 h; ≥18 years; spoke and understood Norwegian; discharged from hospital to their own residence. *Exclusion criteria:* None stated	Impact of voicelessness on patients: - Frustration - Panic - Stress and anxiety - Despair - Irritation - Anger - Powerlessness - Hopelessness - Helplessness
Foster 2010[60]	To describe the lived experience of a tracheostomy tube.	Phenomenological approach using semistructured interviews	One acute NHS trust, UK	3 patients *Inclusion criteria:* TT inserted as an unplanned/ semiplanned procedure. *Exclusion criteria:* None stated	Impact of voicelessness on patients: - Frustration - Anger - Loss of personal identity
Tolotti 2018[63]	To describe the experience and sources of comfort and discomfort in tracheostomy tube patients when communicating with ICU nurses	Interpretative phenomenological approach using in-depth interviews with patients, situated interviews with nurses and participant observation during patients' stay in the ICU.	One ICU in a teaching hospital, Northern Italy	8 patients; 7 nurses *Inclusion criteria (patients):* Aged ≥18; upon first admission to ICU; TT in situ; intubated for more than 5 days; under light sedation (i.e., level 2 of the Ramsay Scale). *Exclusion criteria (patients):* Diagnosed with dementia, psychiatric problems, neurological disorders, and disorientation during MV; language difficulties.	Impact of voicelessness on patients - Frustration - Powerlessness - Resignation - Anger - Isolation - Worthlessness Nurses reported feelings of distress, frustration, and powerlessness
Wallander 2019[64]	To explore the interaction between MV patients and HCPs in ICUs, with emphasis on patients' initiative to communicate.	Observational study using a phenomenological–hermeneutic approach	Two ICUs at a university hospital, Norway	10 patients, 2 relatives; 60 HCPs *Inclusion criteria (patients):* ≥18 years; MV for at least 48 h; RASS score of 0–2; without diagnosed delirium for last 24 h	Impact of voicelessness on patients: - Anxiety - Loss of control - Frustration - Fear - Withdrawal

				Exclusion criteria (patients): Did not speak Norwegian; severely impacted visual, hearing or cognitive capabilities; end-of-life care.	
Quantitative studies					
Kunduk 2010[45]	To study the safety, efficacy, patient tolerance and satisfaction of the Blom TT.	Observational	Teaching hospital Ankara, Turkey	10 patients *Inclusion criteria:* ≥21 years old; weight ≥30 kg; awake; alert; cooperative; able to follow simple commands; able to understand and sign consent; ventilator-dependent and required fully inflated TT cuff; able to respond to simple orientation questions via "mouthing" with intact, functional speech structures, as assessed by a standard oral motor exam. *Exclusion criteria*: Use of special/custom TT (extra proximal length, extra distal length, or foam cuff); known upper-airway obstruction that limited or prevented exhalation through upper airway; excessively dilated tracheostoma; FIO2 requirements ≥60%; PEEP ≥10 cm H2O; tenacious or copious tracheal secretions that required suctioning ≥3 times per hour.	Communication Intervention: Blom Talking Tracheostomy Tube
McGrath 2016[46]	To describe use of the subglottic suctioning port of TT to facilitate patient communication.	Case series	One general ICU, teaching hospital, UK	5 patients *Inclusion/Exclusion criteria:* None stated but included participants were awake, cooperative and attempting to communicate, but reliant on continually inflated TT cuff.	Communication Intervention: Above Cuff Vocalisation via BLUSA TT
McGrath 2019[47]	To determine ability to achieve functional voice with ACV in ventilator-dependent patients; to establish potential benefits of ACV for communication, secretions and swallowing.	Case control	One tertiary single-site hospital with separate general and cardiothoracic ICUs, UK	10 patients *Inclusion criteria:* >16 years old; cuffed BLUS (suctionaid) TT for >72 h; alert; understands consent process, can actively participate in ACV trial (awake and trying to communicate); suitable for FEES as per Royal College of Speech and Language Therapists FEES Position Paper. *Exclusion criteria:* Consent refused; had (or were suspected to have) potentially obstructed upper airway; clinical condition expected to progress to tolerate cuff deflation and one-way speaking valve within 72 h; FEES contraindicated.	Communication Intervention: Above Cuff Vocalisation via BLUSA TT

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Table 2 (*continued*)

First Author, Year	Aim	Design	Setting	Participants	Main concept of interest
Pandian 2020[50]	To determine quality of life using ACV via BLUSA TT	RCT	One large academic tertiary care centre with seven adult ICUs, USA	50 patients *Inclusion criteria:* Adult ICU patients on MV; awake, alert, attempting to communicate; English-speaking; could not tolerate speaking valve on initial screening. *Exclusion criteria*: Delirious; tracheostomy within 48 h; received laryngectomy.	Communication Intervention: Intervention group: ACV using BLUSA TT Control group: standard care (low-tech AAC)
Ull 2020[55]	To investigate application of eye-tracking in intubated & MV patients.	Prospective observational pilot	One university hospital, Germany	11 patients *Inclusion criteria:* ETT or TT and MV; ≥18 years; RASS score of −1 to +1; history of MV of >48 h. *Exclusion criteria:* Patients with TT able to speak for >6 h a day with unblocked cuff.	Communication Intervention: Tobii Dynavox eye-tracking device
Ull 2022[56]	To analyse the feasibility of eye-tracking devices as a communicative approach to the basic needs of ICU and invasively ventilated nonverbal patients	Prospective observational	Three medical and surgical ICUs and intermediate care units of a university hospital, Germany	64 patients *Inclusion criteria:* ETT or TT; invasive ventilation; ≥18 years; RASS score of −1 to +1 or score of <3 on nursing delirium screening scale in patients without sedation; history of invasive ventilation for >48 h; expecting to be ventilated for next 24 h; inadequate nonverbal communication skills. *Exclusion criteria:* Patients with TT able to speak for >6 h a day (e.g., an unblocked cuff); incapable of using nontech or low-tech AAC tools for nonverbal communication.	Communication Intervention: Tobii Dynavox eye-tracking device
Ull 2022[57]	To investigate whether eye-tracking could be used successfully by ICU patients with artificial airways for symptom identification with predefined scales & scores.	Prospective observational	Three medical and surgical ICUs and intermediate care units of a university hospital, Germany	75 patients *Inclusion criteria:* ETT or TT and MV; ≥18 years; RASS score of −1 to 1 or score of <3 on nursing delirium screening scale in patients without sedation; history of MV of >48 h; expecting to be ventilated for the next 24 h; inadequate nonverbal communication skills. *Exclusion criteria:* Patients with a TT able to speak (e.g., an unblocked cuff) or those capable of using nontech or low-tech AAC tools for nonerbal communication.	Communication Intervention: Tobii Dynavox eye-tracking device

Nilsen 2014[62]	To identify interaction behaviours that nurses and nonspeaking critically ill older adults use in ICU and to describe the frequency of use of AAC.	Descriptive correlational study utilising data collected on a subset of older adult patients enrolled in the SPEACS).	32-bed medical ICU and a 22-bed cardiothoracic ICU of an academic medical centre, Pennsylvania, USA	38 patients; 24 nurses *Inclusion criteria (patients):* ≥60 years; MV through ETT or TT; intubated for ≥48 h and expected to remain intubated for an additional 2 days; awake, responding to commands; understands English *Exclusion criteria (patients):* GCS < 13; previous hearing or speech impairment seriously interfering with communication, or previous diagnosis of dementia.	Communication intervention: - Interaction behaviours (verbal and nonverbal behaviours) communicated by both patients and nurses - Unaided AAC strategies (mouthing, gesture, head nods, facial expressions, or nonverbal but communicative action), - Low-technology (drawing, writing, use of picture boards or communication boards) - High-technology strategies (direct selection or scanning using an electronic speech generating device)
Musalia 2023[65]	To evaluate the effectiveness of speech/phrase recognition software in critically ill patients with speech impairments.	Prospective feasibility study	One critical care unit in tertiary hospital, England.	14 patients with tracheostomies *Inclusion criteria:* Admission to critical care; underlying pathology/interventions impairing speech; understanding of English; absence of cognitive impairment hindering ability to use app; ability to follow commands. *Exclusion criteria:* Sedated; too unwell; cognitive impairment.	Communication intervention: Speech/phrase recognition app for voice impaired (SRAVI) downloaded onto handheld android/iOS device with internet access
Mixed-method					
Freeman −Sanderson 2018[61]	To investigate patient-reported experiences of communication function, self-esteem and QoL	Mixed-method approach using structured interviews and questionnaires	One tertiary ICU, Australia	17 patients *Inclusion criteria:* aged >18 years, admitted to the ICU, had undergone a tracheostomy, experienced voiceless during MV; English-speaking. *Exclusion criteria:* None stated	Impact of voicelessness on patients: - Frustration - Anger - Isolation - Loneliness
Pandian 2014[49]	To describe types of talking TTs; present case studies of TT use; propose selection criteria.	Mixed-method approach using retrospective chart review and case studies	One academic tertiary care centre, USA	220 patient records; 4 patient case studies *Inclusion criteria (Chart review):* Patients who had received a TT *(Case studies):* Patients who received a BLUSA cuffed TT. *Exclusion criteria:* None stated	Communication Intervention: - ACV using BLUSA TT
Rose 2018[53]	To assess feasibility of producing intelligible and comprehensible speech with an electrolarynx; to measure anxiety, communication ease, and satisfaction before/after electrolarynx training; to identify barriers and facilitators.	Mixed-method approach: prospective feasibility study with nested qualitative study	One specialised weaning centre and an ICU at a large community teaching hospital, and an ICU at a tertiary academic hospital in Toronto, Canada.	24 patients Qualitative study: 23 patients; 7 relatives; 9 clinicians *Inclusion criteria:* TT due to prolonged MV; unable to tolerate cuff deflation for >1 h; alert, awake; able to follow simple commands; able to read and understand English; ≥18 years old; unimpaired oral-motor capabilities and capable of mouthing words;	Communication intervention: Servox Inton or Trutone electrolarynx

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Table 2 (*continued*)

First Author, Year	Aim	Design	Setting	Participants	Main concept of interest
				consent to participate. *Exclusion criteria:* Pre-existing hearing/speech impairment that seriously interfered with communication; previous diagnosis of dementia.	

*98–100 pertains to two independent studies with the same dataset, but all papers were included as (99) reported on symptom identification and (100) further explored use of eye-gaze in expression of basic needs.
Abbreviations: AAC = augmentative and alternative communication; ACV = above cuff vocalisation; BLUSA = Blue Line ultra® Suctionaid; ETT = endotracheal tube; EQoL-5D = European Quality of Life 5 Dimensions; GCS = Glasgow Coma Scale; HCP = healthcare professional; ICU = intensive care unit; MV = mechanical ventilation; QoL = quality of life; RASS = Richmond Agitation–Sedation Scale; RCT = randomised controlled trial; SLP = speech and language pathologist; SPECAS = study of patient–nurse effectiveness with communication strategies; TT = tracheostomy tube; VRQoL = voice-related quality of life.

Above cuff vocalisation (ACV) may offer a viable solution for patients who cannot tolerate cuff deflation with the technique leveraging the subglottic suction port of the BLUSA tube. A controlled, low-flow stream of air or oxygen is directed in a retrograde manner, travelling upwards through the subglottic suction port and exiting above the cuff. As this gas flow ascends through the trachea, it passes over the vocal cords, exiting through the mouth and potentially resulting in audible vocalisation. Whilst analysis of four cases suggested the potential value of BLUSA,[49] Pandian et al. recognised the limitations to how far these results could be extrapolated and conducted a larger-scale randomised controlled trial ($n = 50$)[50] to better understand its effectiveness and applicability. Findings suggested that the restoration of voice through the use of BLUSA could be empowering for those patients who were awake but unable to tolerate cuff deflation.

Two further studies, one comprising a case series ($n = 5$) and the other a feasibility study ($n = 10$) have explored the utility of ACV.[46,47] While voice quality was akin to a whisper in some cases, McGrath[46] demonstrated that ACV could facilitate oral communication within a controlled, closely supervised environment. The importance of speech and language pathologists (SLPs) in facilitating and optimising the process was underscored. The feasibility study by McGrath[47] further indicates that ACV may offer an effective avenue for verbal communication that would otherwise remain inaccessible to cuff-dependent patients. ACV led to phonation in eight patients, with a notable 72% success rate in producing audible speech.[47] It is worth highlighting that the most frequently reported challenges were excessive secretions and patient discomfort.

Equipped with a polyvinyl chloride cuff and a strategically placed fenestration, the Blom tube offers versatility by accommodating both a standard nonspeech cannula and a speech cannula. The speech cannula facilitates passage of air to the upper airway through the fenestration located above the cuff.[49] During inhalation, the valve flap positioned at the fenestration closes, directing all inspiratory air to the lungs. On exhalation, expiratory pressure enables the fenestration to open, allowing exhaled air to flow to the upper airway for phonation. A pilot study using the Blom tube reported that nine out of ten ventilator-dependent patients were able to produce conversational speech.[45] Patients expressed satisfaction with their vocal quality and overall ability to communicate. However, two participants experienced clinically significant desaturation (<90%), underscoring the necessity for continual monitoring by trained staff. The Blom tube also demonstrated successful phonation in two of three participants in a case report by Pryor,[51] with patients reporting ease and quality of in voicing. Unlike Kunduk's study,[45] no significant physiological deterioration was observed. However, the study highlighted potential concerns regarding patient tolerance over the long term due to increased resistance by inner cannulae.

The electronic artificial larynx (electrolarynx) was explored in a feasibility study involving 24 tracheostomised patients.[53] This handheld device produces vibrated electronic sounds when pressed against the skin on the neck, cheek, or near the glottis. The movement of the lips, jaw, and tongue allows for the creation of speech. Intelligible speech was defined as the correct identification of ≥70% of words by raters, yet the overall mean intelligibility score achieved was 45% of words correctly identified. Notably, intelligibility showed improvement when the participant's face was visible, reaching 57%, although this remained 13% below the feasibility cutoff.

4.5. Facilitators and barriers to communication

Seventeen (74%) papers investigated the factors that either facilitated or hindered communication. Among the eleven papers that identified multidisciplinary collaboration as a

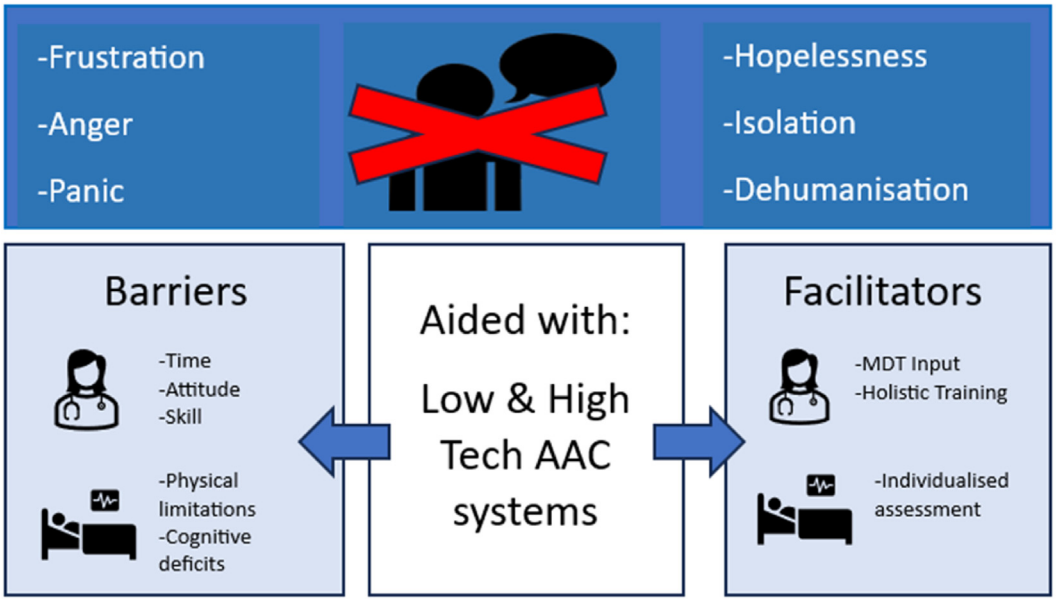

Fig. 2. Themes and subthemes emerging from scoping review.

facilitator,[43,46,47,49,50,52–55,62,64] a substantial 73% reported the involvement of SLPs.[43,47,49,50,52–54,62] Furthermore, seven papers emphasised the importance of successful communication under the guidance of skilled staff.[44,52,58–60,63,64] These papers noted that competence and skill were most effective when combined with a compassionate and empathetic approach. Five studies explored communication-aid specifications including touch-screen devices requiring minimal physical pressure to activate and tilted tray tables[43,44,52,53,59] that facilitated ease of use. Four papers highlighted the importance of family involvement,[43,54,59,63] and four discussed the selection of the most appropriate AAC system for patients based on thorough assessments.[43,44,54,62] Notably, the studies conducted by Scibilia[54] and Musalia[65] were unique in their emphasis on environmental factors as key contributors to successful communication. Scibilia[54] referred to broad environmental distractions, whereas Musalia's[65] focus was on environmental factors directly associated with the technology under investigation.

The most frequently cited obstacle to successful communication was patient-related challenges, as reported across multiple studies.[43,44,50,52–57,59–61,63–65] These challenges were observed by both patients and staff and included physical and cognitive impairments that hindered communication through both nonverbal means and low- and high-tech methods. Factors such as fatigue,[43,44,52,53,59,60] reduced dexterity and strength,[43,44,52,54,60,61,63,64] diminished attention span,[52,54] impaired memory,[61] and fluctuating cognitive status[44,54] were consistently documented. In addition to patient-related issues, staff-related factors, encompassing skill levels, attitudes, and time constraints, were highlighted in eight papers.[44,55–58,61,63,64] Furthermore, technical challenges specific to particular devices were raised as barriers in seven studies.[44,46,47,55–57,65]

5. Discussion

Our search of the literature highlights that the inability to communicate extends beyond the absence of speech; it profoundly affects an individual's overall well-being and identity. As observed by Williams[68] (p. 248), “the silence of speechlessness is never golden”, and this sentiment was evident in several qualitative studies where patients shared their reflections of their communication challenges.[58–60,63] It is also worth noting that as endotracheal intubation is usually undertaken before tracheostomy tube placement, the experience of voicelessness is likely to be further intensified by the time already spent without the ability to speak with an ETT. Findings align with the wider literature on mechanically ventilated patients, with nearly two-thirds reporting negative emotions as a result of their inability to communicate verbally.[69–72] Given the multiple stressors that critical care patients experience, the persistent distress linked to voicelessness highlights the critical need for using a person-centred AAC system.

The second question in this review sought to determine communication strategies for critically ill tracheostomy patients dependent on cuff inflation. Interventions ranged from unaided methods to high-tech-aided AAC systems. The use of technology in healthcare continues to develop apace,[73,74] and this review highlights the feasibility of high-tech strategies, with eye-gaze technology offering distinct advantages to patients with physical limitations. Results align with those of Ju[32] whose systematic review ($n = 18$) on the acceptability of high-tech AAC amongst voiceless critical care patients reported high-tech strategies as a useful alternate. However, it is important to acknowledge that these findings may be constrained by the lack of qualitative research elucidating patients' perspectives on technology. What is evident from this current review is that whilst technology unquestionably holds promise, it is not a universal solution. Although patients expressed the desire for user-friendly aids,[43,44,52,53,59] their communication needs appear to go beyond technical specification. Patients' views on communication strategies seem to be characterised by a paradoxical relationship. Despite the fact that nonverbal modalities regularly consigned communication to a random guessing game,[58,64] patients valued the human-centredness they afforded, including eye contact, touch, and presence.[43,59,63,64] These findings corroborate the ideas of Newman et al.,[75] who suggested that tracheostomy patients want to be seen and heard as a whole person. In this time-critical setting, communication can be eclipsed by life-sustaining treatment, and prior studies on humanisation have reported patients feeling being objectified.[76,77] Increasing focus on humanised critical care has given rise to a conceptual framework recognising communication as a central component.[78] To avoid what de la Fuente-Martos et al.[79] refer to as the “dictatorship of technology”, a balance must be maintained, facilitating staff to adeptly utilise communication tools,

whilst ensuring patients are recognised as individuals.[80] Utilising a blend of communication strategies may prove essential in delivering holistic care to patients throughout their illness trajectory.

The potential need for diverse AAC systems reinforces the importance of ongoing patient assessment to tailor strategies to patients' evolving needs.[29] Within this review, staff skills were emphasised with a specific focus on assessment[43 44 54 62] and communication-aid proficiency,[42 44 62] yet qualities including compassion and empathy were also important. Recognition of one's vulnerability when ill is a significant human need.[81] This was reflected in Foster's[60] study, where acknowledging the lack of voice to the patient was a fundamental element of empathetic practice. Despite their expertise in critical care, staff members may find it challenging to truly empathise with the experience of being a voiceless patient.[82] Tolotti[63] illustrated how, in response, staff members sometimes used avoidance strategies to navigate communication challenges.

Given the weight patients place on interpersonal factors, re-evaluation of communication training may be warranted. Such re-evaluation may necessitate extending beyond assessment and communication-aid proficiency to incorporate the broader scope of patient-centred care. Current findings align with the existing literature, affirming that patients recall memories of their communication experiences in critical care.[83] Consequently, utilising patient narratives could offer a valuable means of imparting unique insights into the profound challenges encountered by voiceless patients. Whilst the concept of listening to the perspectives of those in our care is not novel, models for the effective integration of patient narratives into practice continue to evolve.[84–87] Incorporating narratives alongside traditional communication-aid training may offer the opportunity to see patients with renewed perspectives, nurturing a level of understanding that conventional training methods are unable to replicate.

Prior research has predominantly focussed on critical care communication from a nursing perspective.[37,88] Given that nursing constitutes the largest healthcare sector, this focus is unsurprising, yet collaborative practice, involving professionals from various fields within a multidisciplinary team, is universally recognised as an essential element in tracheostomy care.[89,90] Encouragingly, this review highlights the growing contribution of SLP. Although only two publications[43,54] explicitly addressed the topic from an SLP perspective, and eight papers reported direct SLP involvement, with the consensus being that they are key players in the promotion of communication inclusion.[43 47 49 50 52-54 62] Historically, the integration of SLP into critical care practice has remained limited, often attributed to budgetary constraints.[91–93] Yet, consistent with review findings, broader evidence continues to emphasise the significant role of early SLP in promoting a comprehensive team-based approach to communication rehabilitation.[94–96]

Although this paper signifies a first endeavour at scoping the evidence on communication in tracheostomy critical care patients dependent on cuff inflation, several of its findings are congruent with previous research. The prolonged use of MV, a primary indication for tracheostomy placement, is widely acknowledged as a significant risk factor for ongoing complications.[97] Physical, psychological, and cognitive sequelae emerged as the most frequently occurring barriers to effective communication, factors consistently identified as obstacles in the critical care setting.[30,96,98] Whilst the pursuit of the most effective AAC system may continue, it is important to acknowledge that impairments inherent in the critical illness trajectory may remain. Therefore, whilst many tracheostomy patients are alert and awake, expecting them to become proficient in specific aids may be unrealistic, further supporting the concept that a universal approach may be unachievable. This underscores the significance of ongoing bedside assessments to select the most appropriate strategies throughout the patient's journey.[28 33]

5.1. Strengths and limitations

This review represents a significant effort in consolidating knowledge regarding communication in critically ill tracheostomy patients dependent on cuff inflation. It is strengthened through the rigorous methods undertaken by an experienced, interprofessional research team including two critical care nurses and a critical care physiotherapist. An additional strength of this review is its engagement with stakeholders to help define the objectives, thus enhancing its relevance and applicability. This review has several limitations, including restrictions in language and date due to time constraints, potentially leading to the omission of relevant papers. Moreover, obtaining comprehensive data from all articles was challenging due to incomplete information in some studies and many studies failing to differentiate between patients with ETTs and those with tracheostomy tubes.

6. Recommendations and implications for practice

Changes in communication function due to tracheostomy have been well described in the literature. Whilst a diverse range of AAC systems exists, offering opportunities to enhance communication, caution is warranted. Further research comparing the effectiveness of different communication strategies will bolster existing evidence. Nevertheless, the fluctuating medical status that often characterises critical illness may raise challenges regarding identification of an optimal mode of AAC. Evidently, what works for one patient may not have the same benefits for others, and patients may transition through different communication strategies at different timepoints in their critical care stay. This reinforces the importance of individualised and ongoing bedside assessment to ensure a tailored approach to communication. Notably, despite the availability of various AAC systems, the human factors afforded through unaided modalities were particularly important to patients. Striving for increased integration of SLP, alongside the adoption of a holistic approach to training, holds the potential to foster a more humanised approach to meeting patients' communication needs.

7. Conclusion

This review provides an important contribution to the existing evidence on communication with nonvocal critical care tracheostomised patients and identifies several areas that merit additional investigation. Facilitation of effective communication in critically ill tracheostomy patients dependent on cuff inflation is integral from a psychological perspective. AAC systems, whilst feasible in this population, are not without their limitations, and it may be that a universal approach does not exist. This reinforces the need for ongoing assessment with a greater MDT collaboration potentially leading to improvement in practice. Embracing a holistic approach to communication training could enhance the patient experience.

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Credit authorship contribution statement

Carla McClintock: Conceptualisation, data curation, formal analysis, investigation, methodology, roles/writing- original draft, writing—review and editing, visualisation, project administration,

funding acquisition. **Daniel F. McAuley**: Supervision, writing—review and editing, funding acquisition. **Lisa McIlmurray**: Validation, data curation. **Asem Abdulaziz R Alnajada**: Validation, data curation. **Bronwen Connolly**: Conceptualisation, data curation, methodology, project administration, supervision, validation, visualisation, writing—review and editing, funding acquisition. **Bronagh Blackwood**: Conceptualisation, data curation, methodology, project administration, supervision, validation, visualisation, writing—review and editing, funding acquisition.

Conflict of interest

None.

Data availability statement

The authors confirm that the data supporting the findings of this study are available within the article [and/or] its supplementary materials.

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Appendix A. Supplementary data

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