Dysphagia
https://doi.org/10.1007/s00455-021-10389-y

ORIGINAL ARTICLE

Dysphagia in Intensive Care Evaluation (DICE): An International Cross-Sectional Survey

Peter E. Spronk[1,2] · Laura E. J. Spronk[1,2] · Ingrid Egerod[3] · Jennifer McGaughey[4] · Jackie McRae[5] · Louise Rose[6] · Martin B. Brodsky[7,8,9] on behalf of the DICE study investigators

Received: 13 June 2021 / Accepted: 31 October 2021

Abstract

Dysphagia occurs commonly in the intensive care unit (ICU). Despite the clinical relevance, there is little worldwide research on prevention, assessment, evaluation, and/or treatment of dysphagia for ICU patients. We aimed to gain insight into this international knowledge gap. We conducted a multi-center, international online cross-sectional survey of adult ICUs. Local survey distribution champions were recruited through professional and personal networks. The survey was administered from November 2017 to June 2019 with three emails and a final telephone reminder. Responses were received from 746 ICUs (26 countries). In patients intubated > 48 h, 17% expected a > 50% chance that dysphagia would develop. This proportion increased to 43% in patients intubated > 7 days, and to 52% in tracheotomized patients. Speech-language pathologist (SLP) consultation was available in 66% of ICUs, only 4% reported a dedicated SLP. Although 66% considered a routine post-extubation dysphagia protocol important, most (67%) did not have a protocol. Few ICUs routinely assessed for dysphagia after 48 h of intubation (30%) or tracheostomy (41%). A large proportion (46%) used water swallow screening tests to determine aspiration, few (8%) used instrumental assessments (i.e., flexible endoscopic evaluation of swallowing). Swallowing exercises were used for dysphagia management by 30% of ICUs. There seems to be limited awareness among ICU practitioners that patients are at risk of dysphagia, particularly as ventilation persists, protocols, routine assessment, and instrumental assessments are generally not used. We recommend the development of a research agenda to increase the quality of evidence and ameliorate the implementation of evidence-based dysphagia protocols by dedicated SLPs.

Keywords Critical care · Dysphagia · Intensive care · Survey · Swallowing

Abbreviations

ICU	Intensive care unit
FEES	Flexible endoscopic evaluation of swallowing
NEMS	Neuromuscular electrical stimulation
PES	Pharyngeal electrical stimulation
PEG	Percutaneous endoscopic gastrostomy
SD	Standard deviation
sEMG	Surface electromyography
SLP	Speech-language pathologist
VFSS	Videofluoroscopic swallowing study
V-VST	Volume–viscosity swallow test

✉ Peter E. Spronk
p.spronk@gelre.nl

1 Intensive Care Department, Gelre Hospitals, Albert Schweitzerlaan 31, 7334 DZ Apeldoorn, The Netherlands

2 Expertise center for Intensive care Rehabilitation Apeldoorn – ExpIRA, Apeldoorn, The Netherlands

3 Intensive Care Unit, Rigshospitalet, and Health & Medical Sciences, University of Copenhagen, Copenhagen, Denmark

4 School of Nursing and Midwifery, Queen's University Belfast, Belfast, UK

5 Center of Allied Health, St George's, University of London, London, UK

6 Florence Nightingale Faculty of Nursing, Midwifery and Palliative Care, King's College London, London, UK

7 Department of Physical Medicine & Rehabilitation, Johns Hopkins University, Baltimore, MD, USA

8 Division of Pulmonary and Critical Care Medicine, Johns Hopkins University, Baltimore, MD, USA

9 Outcomes After Critical Illness and Surgery Research Group, Johns Hopkins University, Baltimore, MD, USA

Published online: 29 January 2022

Background

Dysphagia is defined as the complaint of and/or physiologic difficulty to effectively transfer food and liquid from the mouth, through the pharynx, esophagus, and into the stomach [1]. Dysphagia occurs commonly in hospitalized patients [2] and especially in the intensive care unit (ICU), with a reported prevalence ranging from 3 to 62% [3] in patients following endotracheal intubation. Dysphagia has been associated with aspiration [3, 4], pneumonia [1], malnutrition [5], dehydration, prolonged ICU [6] and hospital stay [7], decreased health-related quality of life [8], and increased mortality [9].

Dysphagia may occur after extubation in the ICU where different mechanisms are in play, such as critical illness-associated neuropathy and myopathy, dysfunctional oropharyngeal and laryngeal sensation, cognitive impairment, gastroesophageal reflux, and a lack of synchronicity between breathing and swallowing [10]. Iatrogenic trauma to larynx, pharynx, and upper trachea caused by endotracheal and tracheostomy tubes and transesophageal echocardiogram probes may also play a role [11–13]. Dysphagia not only poses an immediate problem after extubation but also in the long-term after ICU discharge [6, 9]. Patients with post-extubation dysphagia can take more than 6 months to recover [6], highlighting the importance of dysphagia as an issue in the ICU setting and the need for dysphagia assessment, and treatment.

Despite the clinical relevance, there is little research and no internationally recognized ICU-specific guidelines for prevention, assessment, evaluation, and/or treatment of dysphagia for ICU patients. As a result, little is known about practice variations in the way dysphagia is prevented, assessed, and treated in ICUs worldwide [14–16].

We designed and distributed an international survey to determine (a) ICU team awareness of the prevalence and risk of dysphagia; (b) perceived best practices; and (c) current ICU practices for dysphagia management.

Methods

Design and Survey Distribution

We conducted a multi-center, self-administered survey sent to 3823 adult ICUs across 26 countries. We included a convenience sample of countries in which we identified a local study coordinator. These local coordinators were responsible for translation and back-translation of the survey, national distribution aiming for maximal response rate, and obtaining ethics approval if required according to national law and regulations. Coordinators were identified through professional networks and personal recommendations by the initial study writing group (M.B. Brodsky, L. Rose, P.E. Spronk). Coordinators agreed to identify and contact the ICUs in their country/region, distribute the survey, and follow-up with the participating ICUs by reminder e-mails and telephone calls to maximize response rate. Each coordinator instructed participating ICUs in their country/region to discuss completion of the questions with all healthcare professionals involved in the assessment and treatment of dysphagia in the ICU, including intensivists, ICU nurses, otolaryngologists, and speech-language pathologists (SLPs). Similar to previous surveys conducted by our group [17, 18], we asked survey respondents to provide answers based on the team opinion reflecting the daily clinical approach in that specific ICU. Thus, for the purpose of this study, respondents are ICUs (i.e., 1 survey completed per ICU).

Ethical Considerations

Research ethics approval for survey conduct was obtained according to the requirements of each country by national study coordinators. Written confirmation of ethics approval, or the confirmation that requirements were waived, was obtained by the principal investigator (P.E. Spronk) from all national study coordinators before data collection. Consent to participate in this research study was implied with the completion and submission of the survey.

Survey Development

Our study group developed an online survey with the initial items generated from a review of available evidence and adaptation of a Dutch survey on ICU dysphagia previously conducted by the study group [15]. We used an iterative item generation process followed by a discussion with the original survey development team. Potentially ambiguous questions were either changed or omitted for the optimization of the final questionnaire. The survey underwent three rounds of revision for further refining of the domains and questions. We then sent the survey to an external expert panel representing stakeholder professions: two intensivists, three ICU nurses, one otolaryngologist, and two SLPs. These expert panelists were not involved in the study in any other manner. The expert panel assessed survey comprehensiveness, redundancy, clarity, face validity, and time to complete [19]. For administration in non-English-speaking countries, the survey was translated and back translated by a translator in that particular country in consultation with the country/regional coordinator.

Survey

The survey contained 7 respondent (ICU) demographic questions and 39 questions in 3 domains: (1) awareness (10 questions), (2) perceived best practice (13 questions), and (3) current practice (16 questions). Topics included hospital and ICU characteristics, perceptions of prevalence and importance of dysphagia, assessment methods, measures taken to prevent complications of dysphagia (e.g., aspiration), and dysphagia interventions. The survey responses included a mix of multiple choice, check boxes, matrix rating scales, and 7-point Likert scales. The scales were inverted for 3 of 10 questions to discourage respondents from entering the same value for each question decreasing bias (i.e., acquiescence response set) [20, 21]. The final version of the distributed survey is shown in e-appendix 1.

Data Collection

Google Forms was used as the electronic survey interface. Country/regional study coordinators emailed the Google Forms link to ICU department managers of all known ICUs in their respective countries without prior contact between November 2017 and June 2019. A maximum of three email reminders were sent by the local study coordinators to the non-responders at two-week intervals. Subsequently, one round of telephone calls was made to further increase study participation.

Data Management and Analysis

Survey data were exported from Google Forms to an Excel workbook by the study coordinating center in the Netherlands. The data were then cleaned and analyzed. Individual Likert scale results were expressed as means with standard deviations (SD) where continuous scales with equally spaced integers were presented [22]. All questions requiring Likert scale data were analyzed as ratings of disagreement (1–3), indifference/neutral/no opinion (4), or agreement (5–7) or inverted when appropriate. In the case of inversion, the data are reported after a linear transformation to put all data on the same scale. The questions pertaining to the assessment methods (i.e., measures taken to prevent aspiration/aspiration pneumonia, interventions, and estimated prevalence and assessment of dysphagia) were expressed as the proportion of respondents whose answer was > 50% (i.e., 51–75% and > 75%). This approach was chosen to describe the number of ICUs that agreed with the questions statement in the majority of cases. Other values were expressed as response frequency with the corresponding proportion where appropriate. Valid percentages of responses were used assuming the missing values were distributed proportionately among response categories. Data were analyzed using the Statistical Package for the Social Sciences, version 23 (SPSS Inc, Chicago, IL, USA).

Results

Demographics

The survey was distributed in 26 countries, across 3 continents. The overall response rate was 746/3823 ICUs (19.5%). Rates varied in the participating countries (Table 1). Responding centers varied in both hospital and ICU size, with the most common ICU size being 5–9 beds (261; 35%). The results as shown in the tables did not change if ICU size was considered separately. An SLP was available in 490 (66%) ICUs, however, only 30 (4%) of ICUs reported a dedicated SLP (Table 1).

Dysphagia Awareness and Perceived Consequences

Respondents from 330 (47%, Table 2) ICUs perceived that dysphagia is common in their ICU. There were 321 (43%) responding ICUs that perceived dysphagia to occur in > 50% of patients intubated > 7 days. Moreover, 388 (52%) perceived dysphagia to occur in > 50% of patients with tracheostomies. Most responding ICUs agreed that dysphagia is associated with a longer duration of intubation (472; 67%), and influences ICU length of stay (451; 64%), whereas fewer perceived dysphagia as a risk of ICU readmission (273; 39%). Most believed consequences included delayed return to independent functioning (619; 87%), and an increased need for long-term facilities or nursing homes after ICU discharge (559; 79%). Fewer (295; 42%) ICUs reported prolonged hospital length of stay as a perceived consequence (Table 2).

Perceived Best Practice

Most ICUs (460; 66%) agreed there should be a standardized protocol or algorithm to assess post-extubation dysphagia (mean 5.2; SD 2.2 on 7-point Likert scale). Most (487; 73%) ICUs (mean 5.4; SD 1.7) agreed all patients requiring intubation > 48 h should be routinely assessed for dysphagia post-extubation; fewer (310; 46%) ICUs agreed routine dysphagia assessment should occur in all ICU patients admitted > 48 h irrespective of intubation (mean 4.3; SD 1.9) (Table 2).

Current Practice

Most ICUs (532; 77%) did not have a standardized protocol that defines which patients should be assessed for dysphagia. In patients intubated > 48 h, 17% expected a > 50%

Table 1 ICU demographic characteristics

Country	Responses	ICU patient capacity (beds)						SLP available		
	N (%)	< 5	5–9	10–14	15–19	20–49	> 50	Yes, ICU dedicated	Yes, not ICU dedicated	No
Total	746 (20)	45	261	226	80	117	19	30	460	258
Australia	12 (2)	0	1	4	1	4	2	1	11	0
Austria	24 (3)	0	16	7	1	0	0	3	17	4
Belgium	11 (2)	0	0	3	2	6	0	0	11	0
Cyprus	14 (2)	0	8	4	2	0	0	0	8	6
Czech Republic	4 (1)	0	2	1	1	0	0	0	4	0
Denmark	28 (4)	1	15	8	2	2	0	2	9	17
England	37 (5)	1	6	7	3	17	3	5	31	1
Finland	15 (2)	0	10	2	0	3	0	0	13	2
France	7 (1)	0	3	2	1	1	0	0	5	2
Germany	29 (4)	0	1	9	4	8	7	5	21	3
Greece	36 (5)	6	19	11	0	0	0	0	0	36
Ireland	1 (0)	1	0	0	0	0	0	0	1	0
Italy	46 (6)	1	22	20	2	1	0	1	16	29
Japan	150 (20)	16	52	55	15	11	1	3	120	27
Netherlands	32 (4)	3	6	8	4	11	0	0	32	0
New Zealand	12 (2)	0	2	5	3	2	0	0	12	0
Northern Ireland	1 (0)	0	0	0	0	1	0	0	1	0
Norway	31 (4)	9	12	9	1	0	0	0	17	14
Canada	59 (8)	0	8	18	12	21	0	1	58	0
Poland	49 (7)	0	23	10	8	8	0	0	15	34
Portugal	13 (2)	1	8	4	0	0	0	1	10	2
Scotland	5 (1)	1	1	1	2	0	0	0	5	0
Slovakia	19 (3)	4	11	4	0	0	0	3	0	16
Spain	36 (5)	0	7	11	6	12	0	0	12	24
Sweden	15 (2)	0	12	3	0	0	0	0	13	2
Switzerland	12 (2)	0	5	4	1	2	0	3	6	3
Turkey	39 (5)	1	6	13	8	7	4	0	3	36
Wales	9 (1)	0	4	3	1	1	0	2	7	0

ICU intensive care unit, *SLP* speech-language pathologist. The response % indicates the number of responding ICUs overall or per country as a proportion of the distributed number of surveys overall or per country

chance that dysphagia would develop. Nevertheless, in those patients assessment for dysphagia > 50% of the time occurred in only 227 (30%) ICUs. Tracheotomized patients were assessed > 50% of the time for dysphagia in 306 (41%) ICUs (Table 2). The most common method used to confirm the presence of dysphagia was a water swallow test (343; 46%) ICUs for > 50% of assessments (Fig. 1).

The most common measures taken to prevent aspiration or aspiration pneumonia were oral hygiene, i.e., tooth brushing after every meal, cleaning removable prostheses once per day, professional oral healthcare provided by someone other than an ICU nurse (633; 89%), and postural adjustments (611; 86%, Fig. 2). Few ICUs reported implementation of dysphagia therapy. The most common interventions were repetitive swallowing exercises (171; 24%), chin tuck against resistance/Shaker exercise [23, 24] (164; 23%), and respiratory exercises. Surface electromyography (sEMG) biofeedback training or neuromuscular electrical stimulation techniques were rarely used (Fig. 3).

Discussion

This international cross-sectional study reports data on ICU team awareness of dysphagia and perceived best and current practices from > 700 ICUs across 26 countries. Respondents were reasonably aware of the frequency of dysphagia and its associated complications. Despite recognition of evidence-based protocols and routinely scheduled dysphagia assessment as best practices by most responding ICUs, few

Table 2 Awareness, current practice, and perceived best practices

Survey item	Proportion in agreement	Mean (SD)[a]
Dysphagia influences delay of return to normal functioning	619/708 (87%)	5.9 (1.2)
Dysphagia influences the need for long-term care	559/708 (79%)	5.6 (1.4)
ICUs should routinely screen all patients requiring > 48 h of intubation for post-extubation dysphagia	487/671 (73%)	4.3 (1.9)
Dysphagia is associated with the duration of intubation	472/708 (67%)	5.0 (1.5)
ICUs should have a standard protocol for screening for post-extubation dysphagia	460/671 (66%)	5.2 (2.2)
Dysphagia influences the length of ICU stay	451/708 (64%)	4.8 (1.8)
Dysphagia is common in our ICU	330/708 (47%)	4.3 (1.6)
ICUs should routinely screen all patients admitted > 48 h in ICU for dysphagia before discharge	310/671 (46%)	5.4 (1.7)
Dysphagia influences the length of hospital stay	295/708 (42%)	3.8 (2.2)
Dysphagia influences the risk of ICU readmission	273/708 (39%)	3.8 (2.1)
		N (%)
Standard dysphagia protocol available (%)		159 (23)
Screening after extubation in > 50% of patients intubated > 48 h (%)		227 (30)
Screening after tracheostomy during ICU admission in > 50% of patients (%)		306 (41)

Agreement was defined as a score of 5–7 on a Likert scale where 4 was rated as indifference, and 1–3 were rated as disagreement. Scales that were inverted in the survey were reversed for presentation in the table. Numbers of responses are not consistent, because not all questions were answered by all ICUs

SD standard deviation, *ICU* intensive care unit

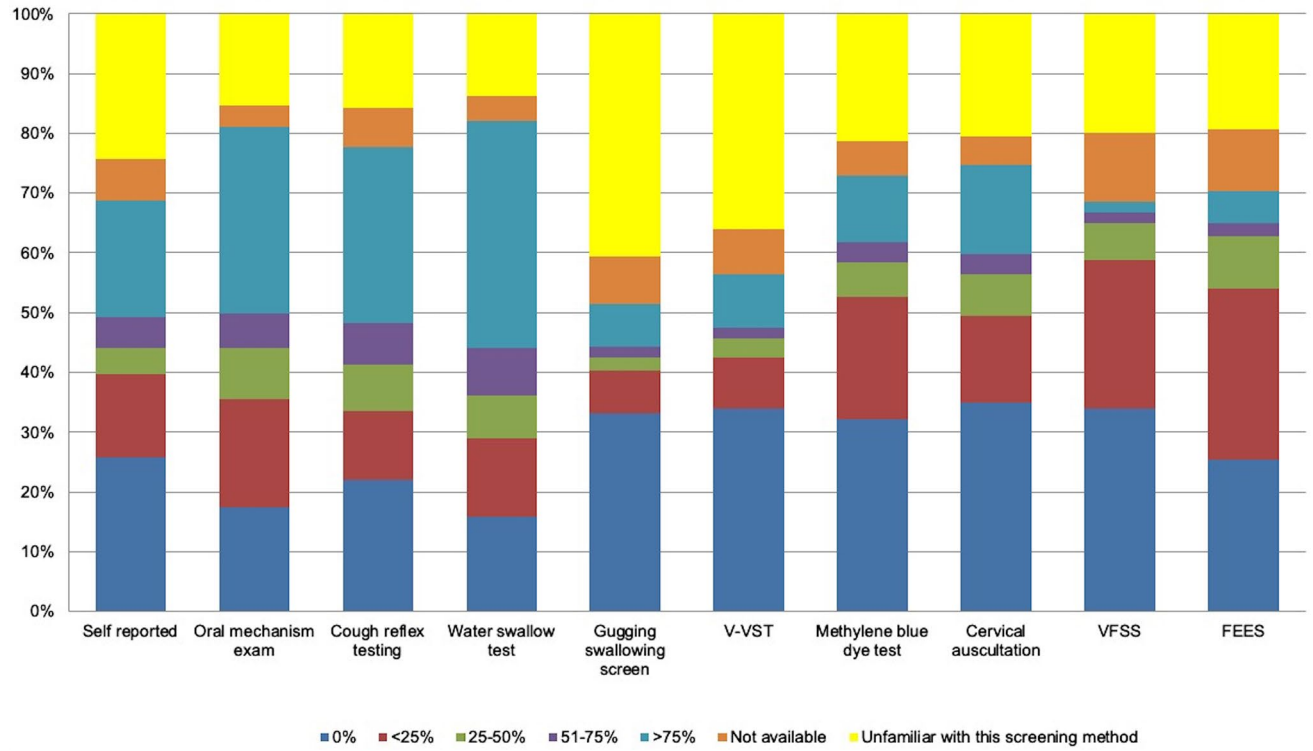

Fig. 1 Assessment methods used to detect oropharyngeal dysphagia. FEES fiberoptic endoscopic evaluation of swallowing, *VFSS* video fluoroscopic swallowing study, *V-VST* volume–viscosity swallow test

routinely screened for dysphagia using appropriate methods. Protocols to guide dysphagia assessment and management are not used in most ICUs, and effective treatments have yet to be adopted.

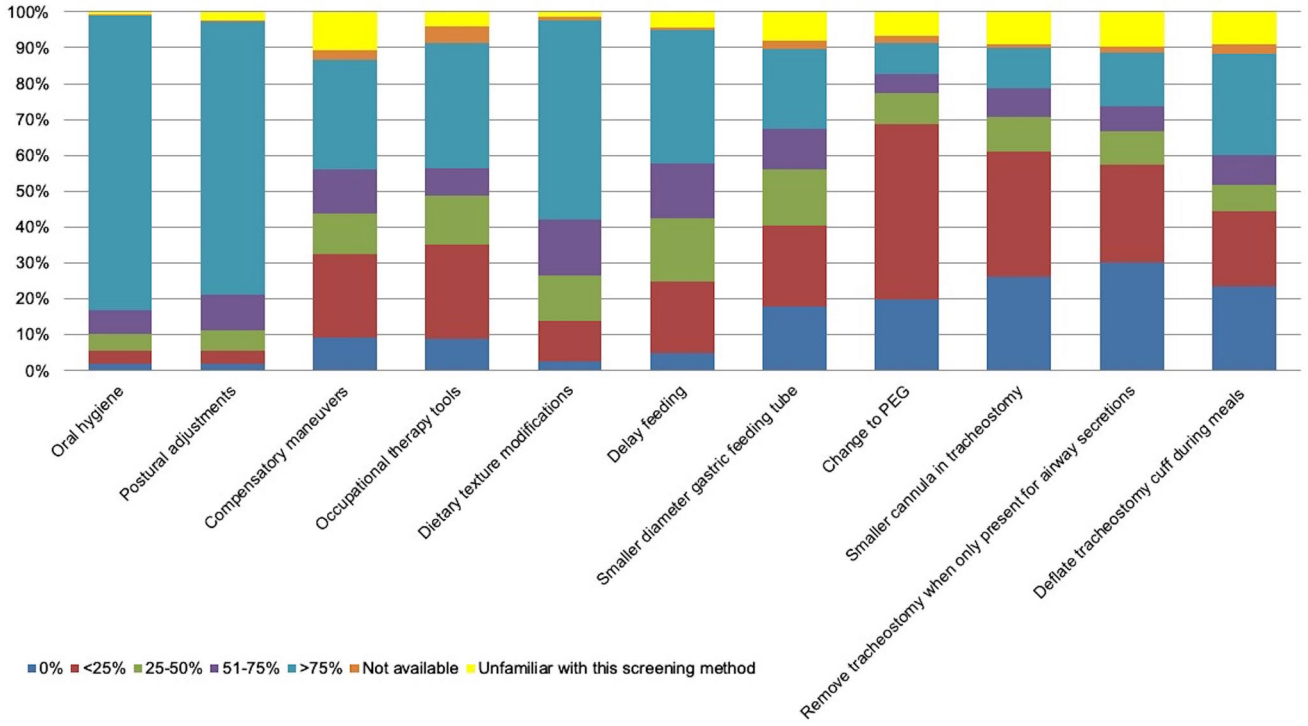

Fig. 2 Measures taken to prevent aspiration/aspiration pneumonia. *PEG* percutaneous endoscopic gastrostomy

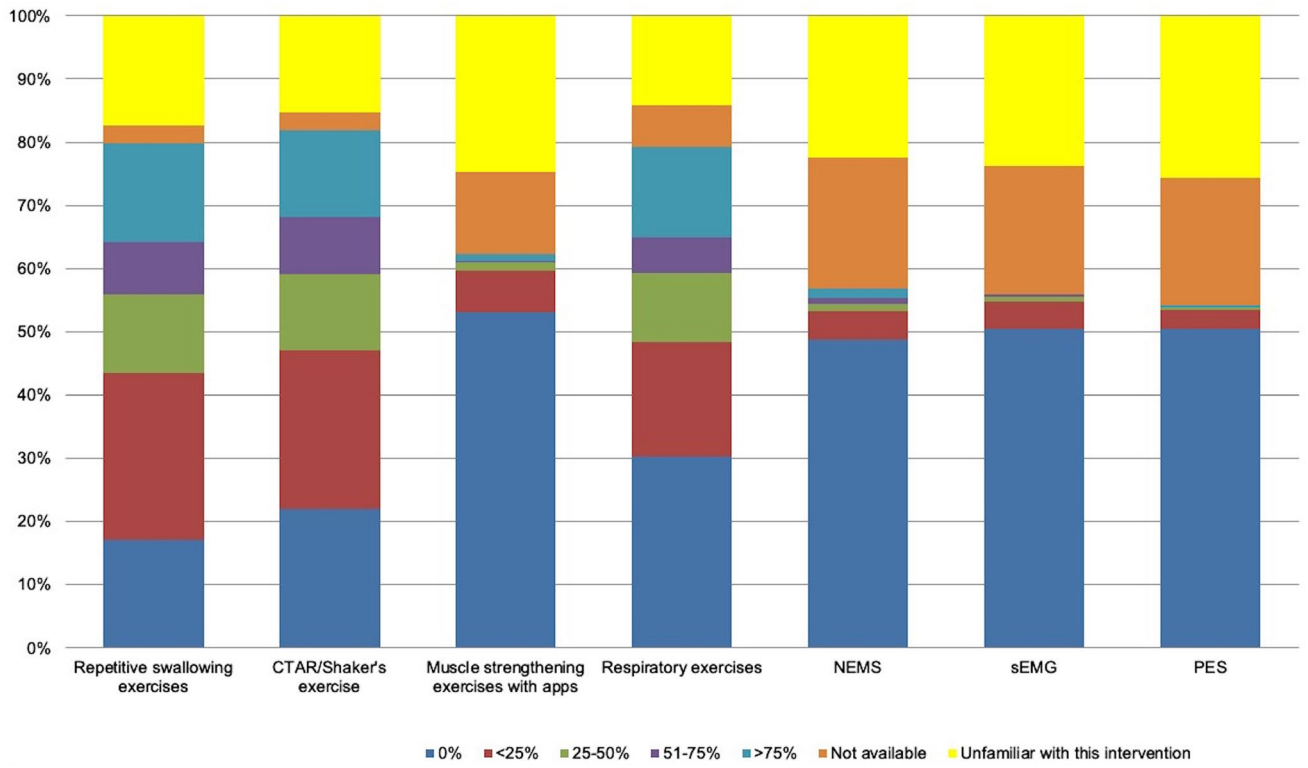

Fig. 3 Interventions used to treat oropharyngeal dysphagia. *CTAR* chin tuck against resistance, *PES* pharyngeal electrical stimulation, *sEMG* surface electromyography biofeedback, *NEMS* neuromuscular electrical stimulation

Awareness of Dysphagia Prevalence and Consequences

Our responding ICUs estimation of the frequency of dysphagia occurrence is congruent with the current evidence base suggesting good awareness of dysphagia as an issue in the critically ill. Previous reports indicate the occurrence of dysphagia following endotracheal intubation ranges 3–62% [3, 12, 25], and following tracheostomy ranges 43–50% [26, 27]. Accordingly, many respondents in our survey thought that dysphagia was associated with a longer duration of intubation, which has also been demonstrated in the literature [28–30].

We found that ICU team awareness of ICU-acquired dysphagia is lower across the various countries included in our present multinational study when compared with a Dutch national ICU survey [15], the MAD-ICU study in Germany [14], and the Swiss survey of dysphagia care [31]. Despite the awareness of dysphagia in the ICU, the implicit consequence to act and apply specific interventions is far less prevalent in our surveyed ICUs.

Perceived Best Practice

Most respondents agreed that there should be routine assessment of dysphagia after extubation in patients being intubated > 48 h. The assessment could be completed within the first hour after extubation [32]. The importance of assessment for dysphagia after prolonged intubation underscored in recent studies that have found a strong association between the prevalence of dysphagia and prolonged duration of intubation [29, 33–36]. Most ICUs agreed that a standardized protocol to assess for post-extubation dysphagia should be available. However, few responding ICUs had such a protocol. A standardized assessment protocol could help to identify patients with or at risk of dysphagia earlier, enabling more timely interventions, possibly improving the outcome. Our findings suggest a knowledge-to-implementation gap that should be addressed to improve dysphagia management.

Current Practice: Protocol, Diagnosis, and Interventions

Most responding ICUs reported that they do not have a standardized protocol for dysphagia assessment, consistent with the previous studies [14, 15, 37, 38]. The absence of a protocol for dysphagia may have influenced the ICU team's attitude towards neglecting dysphagia in parallel with other ICU problems like delirium [39], pain [40], and weaning from the ventilator [41]. Only a small group of ICUs routinely assess patients for dysphagia following extubation after ≥ 48 h of intubation or tracheostomy, which corresponds with the practice in the United States [42] and the results from the Dutch national survey [15]. This may indicate that many patients with dysphagia are not recognized leading to inherently delayed or absent appropriate interventions. A recent report from Australia indicated that SLPs did not receive ICU-specific training, which also may explain the lack of testing, but also may illustrate the lack of access to a dedicated SLP [43].

We found nearly 50% of responding ICUs use the water swallow test to assess for dysphagia. This finding is somewhat surprising since water swallow testing methods assess for overt aspiration, with variable diagnostic accuracy depending on the type of test used, and are not sensitive for detecting silent aspiration [44]. This suggests that many patients may not have their dysphagia recognized. Few responding ICUs used gold standard methods for diagnosing dysphagia, flexible endoscopic evaluation of swallowing (FEES) or videofluoroscopic swallowing study (VFSS), a finding similar to that reported in a US survey [38]. This may be due to the lack of technology, dedicated SLPs with training in the use of these assessments, transporting patients to fluoroscopy, and difficulties transporting the equipment to the ICU environment.

In patients with suspected or diagnosed dysphagia, the most commonly used methods to decrease the risk of aspiration were oral hygiene, dietary texture modification, and postural adjustments. Regular oral hygiene ensures clearance of gram-negative bacteria, reducing the risk of aspiration pneumonia, a common consequence of dysphagia [45, 46]. Positional adjustments such as the chin-tuck posture may reduce aspiration, but efficacy should be checked with FEES or VFSS [47]. Both interventions may help reduce aspiration pneumonia, but do not improve swallowing physiology.

Our respondents identified the intervention most commonly used to treat dysphagia was swallowing exercises to increase muscle strength including chin tuck against resistance or the Shaker exercise [23, 24] in addition to respiratory exercises, however, few ICUs reported their use. Notably, despite being available for several years and evidence of effective treatment of dysphagia, surface electromyography (sEMG) biofeedback training was rarely used [46, 47]. Pharyngeal electrical stimulation (PES), a new tool currently with limited clinical distribution according to the survey, may enhance reorganization of the swallowing motor-cortex and facilitate activation of corticobulbar pathways [48] improving readiness for decannulation [49], and reducing pneumonia and reintubation [50].

Limitations

There were several limitations to this study. First, the number of responses we received was in some countries less than anticipated meaning responses may not be representative

of the regions surveyed. In particular, it is likely that we received most responses by the ICUs that were already concerned about the potential problems related to dysphagia. However, in view of the reported results showing a serious lack in implementation of screening tools, protocols to guide dysphagia assessment and management and effective treatments, suggests that we could in fact have underestimated the actual global situation, which could be even more bleak than already indicated by our data. Second, we requested one individual to represent the ICU team's view to complete the survey, which may not fully represent a team view despite our instructions to consult the whole ICU team and may have led to response bias. Third, we did not operationally define the distinction between the words 'screen' and 'assessment' in our survey. In some of the represented countries, for example, The Netherlands, assessment and screening are considered synonymous concepts. In other parts of the world, these might be perceived as different concepts. Although the term *screen* is used frequently in the literature, it did not raise any issues during the development of the stages of the survey. Interpretation of our findings must consider both screening to determine the need for further assessment and a diagnostic procedure. Moreover, these nuances are difficult to interpret in detail, because translations and back-translations were done in participating countries if needed. Finally, no results were obtained from large parts of Asia, the Middle East, Africa, South America, and the USA, limiting generalizability to those countries.

Conclusions

ICU clinicians appear to have a limited awareness of the frequency of dysphagia in ICU patients, associated consequences, and best practices for its assessment and management. However, despite this awareness, descriptions of current practice suggest routine dysphagia screening using appropriate methods is lacking, protocols to guide dysphagia assessment and management are rarely used, and effective treatments have not been adopted. Our data indicate an urgent need for education, skill training as well as the development of a research agenda to increase the quality of evidence and ameliorate the implementation of evidence-based practices to address dysphagia management in the ICU.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00455-021-10389-y.

Acknowlegments Co-authors of DICE study investigator group Survey development team: M. B. Brodsky (Johns Hopkins University, Baltimore, USA); L. Rose (King's College London, London, UK); J. Lut (Gelre Hospitals, Apeldoorn, The Netherlands); P. Clavé (Hospital de Mataró, Universitat Autónoma de Barcelona, Centro de Investigación Biomédica en Red de Enfermedades Aparato DIgestivo, Ciberehd Barcelona, Spain); R. Nanchal (Medical college Wisconsin, USA); Y. Inamoto (Fujita Health University, Aichi, Japan); J. I. van der Hoeven (Radboud University, Nijmegen, The Netherlands); P. E. Spronk (Gelre Hospitals, Apeldoorn, The Netherlands). National study coordinators: A. Freeman-Sanderson (Australia); M. Hiesmayr, C. Veraar (Austria); C. E. Hickmann, R. Gosselink (Belgium); L. Rose, S. Gershman, S. Skoretz, R. Martino (Canada); M. Mpouzika (Cyprus); M. Cerny, V. Chrobok, L. Zeinerova (Czech Republic); I. Egerod, G. Kaldan (Denmark); J. McRae (England); M. Bäcklund (Finland); T. Ramos (France); P. Nydahl (Germany); M. Kalafati (Greece); T. Andrews (Ireland); R. Sperlinga (Italy); H. Katsukawa, F. Kasai (Japan); P. E. Spronk, J. Lut, L. E. J. Spronk (Netherlands); A. Miles (New Zealand); J. McGaughey, S. Duncan (Northern Ireland (UK)); M. Fossum, V. Ágústdóttir, T. Senneset, M. Larsson, G. Hammond (Norway); R. Owczuk (Poland); S. Mestre (Portugal); J. Merriweather (Scotland); M. Tedla, Z. Frajkova (Slovakia); M. Velasco (Spain); E. Akerman (Sweden); A. Sibilla, B. Kertscher, B. Gaechter (Switzerland); S. Serel Arslan, N. Demir (Turkey); G. Jones (Wales).

Authors Contributions All authors of the DICE study investigator group contributed substantially to the conception and design of the study, the acquisition of data, or the analysis and interpretation of the data. All authors of the DICE study investigator group drafted or provided critical revision of the article and provided their final approval of the version submitted for publication. In more detail, material preparation, data collection, and analysis were done by LEJS, JL, and PES. PES drafted the manuscript and members of the writing group (LEJS, MBB, LR, IE, JM, and JM) revised it critically for important intellectual content. Subsequently, the version was distributed among all the other DICE study group investigators for critical appraisal. All authors mentioned as national study coordinators participated in ethical approvals, recruitment, and data collection in their respective countries. See non-anonymized version.

Funding This study was partially funded by the Gelre Hospitals science fund (Grant 2018-012).

Declarations

Conflict of interest No conflict of interest were declared by any of the authors.

Ethical Approval Research ethics approval for survey conduct was obtained according to the requirements of each country by national study coordinators. Written confirmation of ethics approval, or the confirmation that requirements were waived, was obtained by the study investigator (Peter E. Spronk) from all national study coordinators prior to data collection. A paragraph mentioning this information was added to the methods section of the manuscript.

Consent to Participate Returning a survey was indicating consent to participate in this survey by national coordinators who were responsible for contacts with the ICUs in their country/region. The ICUs were allowed to opt out of study participation, but this never occurred.

Consent for Publication All authors read the final version of the manuscript and agreed to publish the paper.

Financial/Nonfinancial Disclosures None declared by any of the authors.

References

1. Baijens L, Clave P, Cras P, Ekberg O, Forster A, Kolb G, Leners JC, Masiero S, Mateos-Nazal, Ortega O, Smithard G, Speyer R, Walshe M ES for SD-EUGMS. White paper: oropharyngeal dysphagia as a geriatric syndrome. Clin Interv Aging. 2016;11:1–16.
2. Spronk PE, Spronk LEJ, Lut J, Gnacke E, Mijnes D, Munster B, et al. Prevalence and characterization of dysphagia in hospitalized patients. Neurogastroenterol Motil. 2020;32:1–8.
3. Skoretz SA, Flowers HL, Martino R. The incidence of dysphagia following endotracheal intubation. Chest. 2010;137:665–73.
4. El Solh A, Okada M, Bhat A, Pietrantoni C. Swallowing disorders post orotracheal intubation in the elderly. Intensive Care Med. 2003;29:1451–5.
5. Carrión S, Cabré M, Monteis R, Roca M, Palomera E, Serra-Prat M, et al. Oropharyngeal dysphagia is a prevalent risk factor for malnutrition in a cohort of older patients admitted with an acute disease to a general hospital. Clin Nutr. 2015;34:436–42.
6. Brodsky MB, Huang M, Shanholtz C, Mendez-Tellez PA, Palmer JB, Colantuoni E, et al. Recovery from dysphagia symptoms after oral endotracheal intubation in acute respiratory distress syndrome survivors. A 5-year longitudinal study. Ann Am Thorac Soc. 2017;14:376–83.
7. Altman KW, Yu G-P, Schaefer SD. Consequence of dysphagia in the hospitalized patient. Arch Otolaryngol Neck Surg. 2010;136:784.
8. Ekberg O, Hamdy S, Woisard V, Wuttge-Hannig A, Ortega P. Social and psychological burden of dysphagia: its impact on diagnosis and treatment. Dysphagia. 2002;17:139–46.
9. Schefold JC, Berger D, Zürcher P, Lensch M, Perren A, Jakob SM, et al. Dysphagia in mechanically ventilated ICU patients (DYnAMICS). Crit Care Med. 2017;45:2061–9.
10. Macht M, Wimbish T, Bodine C, Moss M. ICU-acquired swallowing disorders. Crit Care Med. 2013;41:2396–405.
11. Rousou JA, Tighe DA, Garb JL, Krasner H, Engelman RM, Flack JE, et al. Risk of dysphagia after transesophageal echocardiography during cardiac operations. Ann Thorac Surg. 2000;69:486–9.
12. Brodsky MB, Levy MJ, Jedlanek E, Pandian V, Blackford B, Price C, et al. Laryngeal injury and upper airway symptoms after oral endotracheal intubation with mechanical ventilation during critical care: a systematic review. Crit Care Med. 2018;46:2010–7.
13. Krisciunas GP, Langmore SE, Gomez-Taborda S, Fink D, Levitt JE, McKeehan J, et al. The association between endotracheal tube size and aspiration (during flexible endoscopic evaluation of swallowing) in acute respiratory failure survivors. Crit Care Med. 2020;48:1604–11.
14. Marian T, Dünser M, Citerio G, Koköfer A, Dziewas R. Are intensive care physicians aware of dysphagia? The MAD ICU survey results. Intensive Care Med. 2018;44:973–5.
15. van Snippenburg W, Kröner A, Flim M, Hofhuis J, Buise M, Hemler R, et al. Awareness and management of dysphagia in dutch intensive care units: a nationwide survey. Dysphagia. 2019;34:220–8.
16. Zuercher P, Dziewas R, Schefold JC. Dysphagia in the intensive care unit: a (multidisciplinary) call to action. Intensive Care Med. 2020;46:554–6.
17. Hofhuis JGM, Rose L, Blackwood B, Akerman E, McGaughey J, Egerod I, et al. Clinical practices to promote sleep in the ICU: a multinational survey. Int J Nurs Stud. 2018;81:107–14.
18. Rose L, Blackwood B, Egerod I, Haugdahl HS, Hofhuis J, Isfort M, et al. Decisional responsibility for mechanical ventilation and weaning: an international survey. Crit Care. 2011;15:R295.
19. Burns KEA, Duffett M, Kho ME, Meade MO, Adhikari NKJ, Sinuff T, et al. A guide for the design and conduct of self-administered surveys of clinicians. CMAJ. 2008;179:245–52.
20. Barnette JJ. Effects of stem and Likert response option reversals on survey internal consistency: If you feel the need, there is a better alternative to using those negatively worded stems. Educ Psychol Meas. 2000;60:361–70.
21. Locker D, Jokovic A, Allison P. Direction of wording and responses to items in oral health-related quality of life questionnaires for children and their parents. Community Dent Oral Epidemiol. 2007;35:255–62.
22. Harpe SE. How to analyze Likert and other rating scale data. Curr Pharm Teach Learn Elsevier. 2015;7:836–50.
23. Yoon WL, Khoo JKRLS. Chin tuck against resistance (CTAR): New method for enhancing suprahyoid muscle activity using a Shaker-type exercise. Dysphagia. 2014;29:243–8.
24. Shaker R, Kern M, Bardan E, Taylor A, Stewart ET, Hoffmann RG, et al. Augmentation of deglutitive upper esophageal sphincter opening in the elderly by exercise. Am J Physiol - Gastrointest Liver Physiol. 1997;272:1518–22.
25. de Oliveira ACM, de Friche AA, Salomão MS, Bougo GC, Vicente LCC. Predictive factors for oropharyngeal dysphagia after prolonged orotracheal intubation. Braz J Otorhinolaryngol. 2018;84:722–8.
26. Elpern EH, Scott MG, Petro L, Ries MH. Pulmonary aspiration in mechanically ventilated patients with tracheostomies. Chest. 1994;105:563–6.
27. Tolep K, Getch CL, Criner GJ. Swallowing dysfunction in patients receiving prolonged mechanical ventilation. Chest. 1996;109:167–72.
28. Sassi FC, de Medeiros GC, Zambon LS, Zilberstein B, de Andrade CRF. Evaluation and classification of post-extubation dysphagia in critically ill patients. Rev Col Bras Cir. 2018;45:e1687.
29. Brodsky MB, Gellar JE, Dinglas VD, Colantuoni E, Mendez-Tellez PA, Shanholtz C, et al. Duration of oral endotracheal intubation is associated with dysphagia symptoms in acute lung injury patients. J Crit Care. 2014;29:574–9.
30. Zuercher P, Moret CS, Dziewas R, Schefold JC. Dysphagia in the intensive care unit: epidemiology, mechanisms, and clinical management. Crit Care Critical Care. 2019;23:1–11.
31. Zuercher P, Moret C, Schefold JC. Dysphagia in the intensive care unit in Switzerland (DICE): results of a national survey on the current standard of care. Swiss Med Wkly. 2019;149:1–10.
32. Leder SB, Warner HL, Suiter DM, Young NO, Bhattacharya B, Siner JM, et al. Evaluation of swallow function post-extubation: is it necessary to wait 24 hours? Ann Otol Rhinol Laryngol. 2019;128:619–24.
33. Macht M, Wimbish T, Clark BJ, Benson AB, Burnham EL, Williams A, et al. Postextubation dysphagia is persistent and associated with poor outcomes in survivors of critical illness. Crit Care. 2011;15:R231.
34. Macht M, King CJ, Wimbish T, Clark BJ, Benson AB, Burnham EL, et al. Post-extubation dysphagia is associated with longer hospitalization in survivors of critical illness with neurologic impairment. Crit Care. 2013;17:R119.
35. Malandraki GA, Markaki V, Georgopoulos VC, Psychogios L, Nanas S. Postextubation dysphagia in critical patients: a first report from the largest step-down intensive care unit in greece. Am J Speech-Language Pathol. 2016;25:150–6.
36. Moss M, White SD, Warner H, Dvorkin D, Fink D, Gomez-Taborda S, et al. Development of an accurate bedside swallowing evaluation decision tree algorithm for detecting aspiration in acute respiratory failure survivors. Chest. 2020;158:1923–33.
37. Brodsky MB, Nollet JL, Spronk PE, González-Fernández M. Prevalence, pathophysiology, diagnostic modalities, and treatment options for dysphagia in critically Ill patients. Am J Phys Med Rehabil. 2020;99:1164–70.
38. Macht M, Wimbish T, Clark BJ, Benson AB, Burnham EL, Williams A, et al. Diagnosis and treatment of post-extubation

dysphagia: Results from a national survey. J Crit Care. 2012;27:578–86.
39. Spronk PE, Riekerk B, Hofhuis J, Rommes JH. Occurrence of delirium is severely underestimated in the ICU during daily care. Intensive Care Med. 2009;35:1276–80.
40. Hajiesmaeili MR, Safari S. Pain management in the intensive care unit: do we need special protocols? Anesthesiol Pain Med. 2012;1:237–8.
41. Ely EW, Meade MO, Haponik EF, Kollef MH, Cook DJ, Guyatt GH, et al. Mechanical ventilator weaning protocols driven by non-physician health-care professionals. Chest. 2001;120:454S-463S.
42. Brodsky MB, González-Fernández M, Mendez-Tellez PA, Shanholtz C, Palmer JB, Needham DM. Factors associated with swallowing assessment after oral endotracheal intubation and mechanical ventilation for acute lung injury. Ann Am Thorac Soc. 2014;11:1545–52.
43. Cardinal LA, Freeman-Sanderson A, Togher L. The speech pathology workforce in intensive care units: results from a national survey. Aust Crit Care Elsevier Ltd. 2020;33:250–8.
44. Brodsky MB, Suiter DM, González-Fernández M, Michtalik HJ, Frymark TB, Venediktov R, et al. Screening accuracy for aspiration using bedside water swallow tests. Chest. 2016;150:148–63.
45. Seedat J, Penn C. Implementing oral care to reduce aspiration pneumonia amongst patients with dysphagia in a South African setting. South African J Commun Disord Die Suid-Afrikaanse Tydskr vir Kommun. 2016;63:1–11.
46. Ortega O, Martín A, Clavé P. Diagnosis and management of oropharyngeal dysphagia among older persons, state of the art. J Am Med Dir Assoc. 2017;18:576–82.
47. Ashford J, McCabe D, Wheeler-Hegland K, Frymark T, Mullen R, Musson N, Schooling THC. Evidence-based systematic review: Oropharyngeal dysphagia behavioral treatments. Part III–Impact of dysphagia treatments on populations with neurological disorders. J Rehabil Res Dev. 2009;46:195–204.
48. Restivo DA, Hamdy S. Pharyngeal electrical stimulation device for the treatment of neurogenic dysphagia: technology update. Med Devices Evid Res. 2018;11:21–6.
49. Dziewas R, Stellato R, van der Tweel I, Walther E, Werner CJ, Braun T, et al. Pharyngeal electrical stimulation for early decannulation in tracheotomised patients with neurogenic dysphagia after stroke (PHAST-TRAC): a prospective, single-blinded, randomised trial. Lancet Neurol. 2018;17:849–59.
50. Koestenberger M, Neuwersch S, Hoefner E, Breschan C, Weissmann H, Stettner H, et al. A pilot study of pharyngeal electrical stimulation for orally intubated ICU patients with dysphagia. Neurocrit Care. 2020;32:532–8.

Peter E. Spronk MD

Laura E. J. Spronk MD

Ingrid Egerod PhD

Jennifer McGaughey PhD

Jackie McRae PhD

Louise Rose PhD

Martin B. Brodsky PhD