RESEARCH

Examining the relationship between sepsis and oropharyngeal dysphagia in hospitalised elderly patients: a retrospective cohort study

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Received 30 March 2018
Revised 4 May 2018
Accepted 10 May 2018
Published Online First 2 June 2018

Check for updates

To cite: Sasegbon A, O'Shea L, Hamdy S. *Frontline Gastroenterology* 2018;**9**:256–261.

ABSTRACT

Introduction Elderly people are recognised to be at increased risk of oropharyngeal dysphagia (OPD), the causes of which are multifactorial. Our aim was to identify if sepsis is associated with OPD in the elderly during hospitalisation in the absence of known other risk factors for OPD.

Methods A hospital electronic database was searched for elderly patients (≥65 years) referred for assessment for suspected dysphagia between March 2013 and 2014. Exclusion criteria were age <65 years, pre-existing OPD or acute OPD secondary to acute intracranial event, space-occupying lesion or trauma. Data were collected on factors including age, sex, comorbidities, existing OPD, sepsis, microbiology, recovery of OPD and medication. Sepsis was defined as evidence of a systemic inflammatory response syndrome with a clinical suspicion of infection.

Results A total of 301 of 1761 screened patients referred for dysphagia assessment met the inclusion criteria. The prevalence of sepsis and subsequent OPD was 16% (51/301). The mean age was 83 years (median 81 years). The most common comorbidity was dementia (31%). The majority (84%) failed to recover swallowing during their hospital stay, 12% had complications of aspiration and 35% died. The most common source of sepsis was from the chest (55%). Other factors contributing to the risk for dysphagia included delirium (22%) and neuroactive medication (41%). However, 10% of patients had sepsis and subsequent OPD without other identified risk factors.

Conclusion The prevalence of sepsis and subsequent dysphagia is significant and should be taken into account in any elderly person in hospital with new-onset OPD without other predisposing risk factors.

INTRODUCTION

Swallowing is a fundamental process for enabling life, allowing food and fluid to be ingested safely and efficiently, thereby maintaining normal physiological and biochemical functions. Furthermore, the enjoyment of eating and drinking plays an important part in an individual's perception of their quality of life.[1 2] Dysphagia is defined as difficult/disordered swallowing.[3–5] Various diseases can cause disruption to normal swallowing resulting in dysphagia. Dysphagia has the potential to cause malnutrition, dehydration and aspiration pneumonia, all of which lead to significant morbidity and mortality.[6]

The process of ageing affects the way the oral cavity and pharynx function. However, these changes are a natural part of the ageing process and are not considered pathological. Age-related changes to the process of swallowing are collectively termed presbyphagia.[2 7] As part of the ageing process, there is also breakdown of muscle fibres and a resultant decrease in skeletal muscle mass; otherwise categorised as sarcopenia. Studies have also shown an age-related decrease in tongue and pharyngeal musculature[8 9] alongside a prolongation in the pharyngeal phase of swallowing in healthy elderly individuals.[2 5] These changes mean older individuals have a reduced swallowing reserve and are more prone to developing dysphagia.

Sepsis is a very common cause of mortality, hospitalisation and admission to intensive care units (ICUs). Moreover, 4.7% of deaths in the UK can be attributed to sepsis.[10] Additionally, sepsis is the cause of 27% of admissions to ICUs.[11] Older individuals are more prone to developing sepsis than their younger counterparts. Despite this, only one study has looked at critical illness, sepsis

and oropharyngeal dysphagia (OPD), prospectively investigating two groups of ICU patients, with and without sepsis.[12] In that study, patients were evaluated using fibreoptic endoscopic evaluation of swallowing (FEES) and questionnaires. Nineteen of 30 patients in the sepsis group had dysphagia compared with 7 of 30 in the non-sepsis group. At 4 months, mortality in the sepsis group was 57% compared with 20% in the non-sepsis group. It should be noted that because critical illness has been shown to increase the risk of OPD, the presence of critical illness could be considered a confounding factor in this study.

Thus, given the lack of data concerning the role of sepsis in the aetiology of swallowing dysfunction, our study aim was to quantify the prevalence of OPD in older hospitalised individuals (age ≥65), associated with sepsis alone, without the presence of any other known risk factors of OPD. Our hypothesis was that sepsis would act as an independent predictor of dysphagia in this setting.

METHODS

Patient recruitment

Patients were initially identified from the speech and language therapy (SALT) referral database in a single-centre teaching hospital in the north of England. Subsequent data were drawn from analysis of the medical notes of individual patients using an electronic patient record system (Allscripts: Sunrise EPR, Salford, UK).

The study analysed referral data over a 1-year time frame from March 2013 to 2014. Patients' clinical notes were scrutinised and compared with the research inclusion and exclusion criteria. Inclusion criteria were patients ≥65 years of age; a documented diagnosis of OPD by the SALT team; sepsis and a course of antibiotic therapy. Exclusion criteria were patients <65 years of age; significant documented pre-existing OPD secondary to any cause or acute OPD secondary to stroke and head trauma; space-occupying brain lesion or neurosurgical intervention. Patients were identified for the study using a sequential multistep process as illustrated in figure 1.

Information retrieval

A large amount of information was retrieved for each patient. This can be divided into demographics, pre-existing clinical information, dysphagia, infection and recovery. Regarding demographics, all patients had the following information recorded: age, sex, location of referral, admission and discharge body mass index (BMI). Admission BMIs were recorded within an arbitrary time period of 7 days from admission and discharge BMIs within 7 days of discharge. For pre-existing clinical information, patients had their comorbidities and medications (prior to and during admission) recorded. For dysphagia, pre-existing OPD was recorded if present, and the presence or absence of a baseline SALT assessment on admission was recorded; when OPD was suspected, the method of OPD diagnosis and any suspicion or diagnosis of aspiration pneumonia was also recorded. For infection, any diagnoses of infection were recorded along with the presence or absence of SIRS criteria; location; if antibiotic treatment was initiated and if sepsis was confirmed by positive microbiology. Finally under recovery, the length of time taken to recovery of swallowing function—if any occurred—was recorded in addition to mortality.

Definitions

Definition of sepsis

The decision was made to define sepsis according to the systemic inflamatory response syndrome (SIRS) based 2001 international sepsis criteria (figure 2).[13]

Definition of dysphagia

For the purposes of this study, dysphagia was defined as documented diagnoses of dysphagia by the SALT team in patients' clinical notes. This included clinical diagnoses as well as diagnoses supported by videofluoroscopy (VFS) and FEES.

This method of defining OPD was adopted because SALT staff have two formal roles in a hospital setting: the assessment and management of OPD and the assessment and management of speech disorders. Therefore, they have the most expertise in the clinical diagnosis and further assessment of OPD. Clinical assessment of OPD by trained professionals has been shown to be robust with 42%–90% sensitivity and 59%–91% specificity.[14]

The SALT referral database was used as the basis of patient recruitment in this study. Referrals are sent using the electronic patient record to the shared SALT staff email. Any member of clinical staff can send a referral. Patients are placed nil by mouth until they are formally assessed by the SALT team.

Definition of 'elderly' patients

In this study, elderly patients were defined as being ≥65 years of age. This definition is in line with the WHO definition of an elderly individual.[15]

Data analysis

As this was a retrospective cohort observational study, we calculated the number of cases of OPD subsequent to sepsis in elderly individuals. Prevalence was calculated using the software package SPSS. Results are reported as percentiles and medians with IQR unless otherwise stated.

RESULTS

Patient screening and recruitment

A total of 1761 patients were referred for dysphagia assessment during the study period. On initial screening of the referral database, exactly 301 were

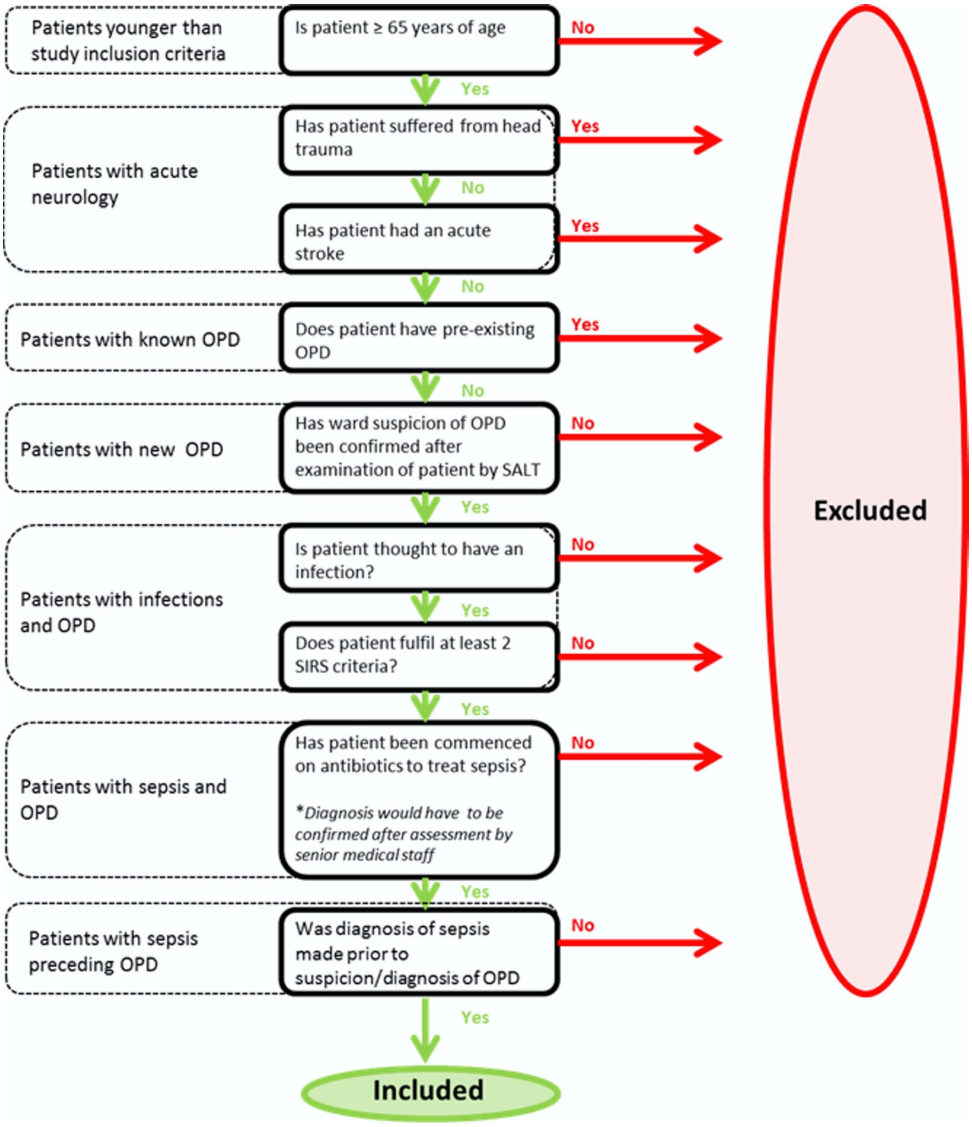

Figure 1 Flow diagram illustrating the multistep process of patient recruitment. OPD, oropharyngeal dysphagia; SALT, speech and language therapy; SIRS, systemic inflammatory response syndrome.

≥ 65, without acute neurology or head trauma and without pre-existing OPD. They were therefore retained for further analysis (figure 1).

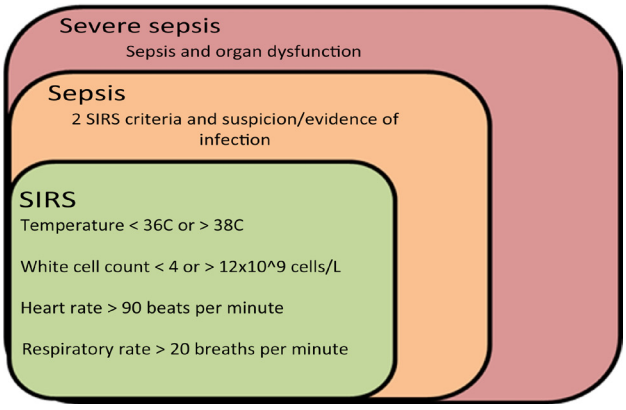

Figure 2 SIRS criteria.

Patient demographics and dysphagia prevalence

The prevalence of sepsis and subsequent OPD within this group of ≥65-year-old, non-ICU patients without pre-existing OPD was 17% (51/301 patients). The other 250 patients were not diagnosed as having OPD when formally assessed by SALT despite the suspicion of the nursing staff or had an unclear temporal relation ship between their sepsis and OPD. The mean age of the dysphagic group was 83 years with a median of 81 (IQR 77–91) years. There was a preponderance of men (59%). Of the OPD group, five (10%) had no other known risk factors of OPD (other than age).

Method of diagnosis

OPD was diagnosed by clinical assessment in 47/51 (92%) patients. VFS was used to diagnose three (6%) patients and FEES in one (2%) patient.

Table 1 Comorbidities of patients with sepsis and subsequent oropharyngeal dysphagia (OPD)

Comorbidities	Number of patients
Chronic obstructive pulmonary disease	12
Cancer	10
Unspecified dementia	9
Chronic kidney disease	8
Atrial fibrillation	7
Type 2 diabetes mellitus	7
Parkinson's disease/Parkinsonism	7
Ischaemic heart disease	6
Cardiac failure	5
Vascular dementia	4
Previous stroke (without any baseline OPD)	4
Epilepsy	3
Bronchiectasis	2
Dementia with Lewy bodies	2
Aortic stenosis	1
Mitral regurgitation	1
Aortic regurgitation	1
Tricuspid regurgitation	1
Alzheimer's dementia	1
Schizophrenia	1
Transient ischaemic attack	1
Gout	1
Akinetic rigid syndrome	1
Oesophagitis	1

None of the above patients irrespective of their comorbidity had pre-existing OPD prior to their admission to hospital.

Location of referrals

A total of 46 (90%) patients were referred to the SALT team from medical wards. Five (10%) patients were referred from the medical high dependency unit.

Types of sepsis

Types of sepsis included 28 chest (55%), 11 mixed (22%), 6 urological (12%), 2 biliary (4%), 1 cellulitis (2%), 1 intra-abdominal (2%), one gastroenteritis (2%) and one unknown (2%). Confirmatory microbiology including sputum, urine, stool and blood cultures was positive in 15 (29%) patients.

Mortality and aspiration

Six patients (12%) had suspected complications of aspiration and 18 (35%) died during their admission.

Contributing factors

Other factors potentially contributing to the risk for dysphagia included delirium (22%) or confusion (29%) and intake of medication potentially contributing to OPD (41%). These included any neuroleptic agents or medications with a potential to impair an individual's level of consciousness, for example, opiates, benzodiazepines or other hypnotic agents.

Comorbidities

The comorbidities are shown in table 1. Of the 51 patients with sepsis and subsequent dysphagia, the most common comorbidities (defined as a prevalence of over 10%) were dementia from all causes (31%), chronic obstructive pulmonary disease (COPD) (24%), cancer (20%), chronic kidney disease (16%), atrial fibrillation (14%), Parkinson's disease/Parkinsonism (14%), diabetes (14%), ischaemic heart disease (12%) and heart failure (10%).

Recovery of swallowing

Eight (16%) patients recovered their swallowing to their pre-sepsis baseline. This was defined as any alteration in their ability to eat and drink prior to admission as documented in their medical notes and clinic letters. Forty-three patients (84%) failed to recover their swallowing to their baseline prior to being discharged or passing away. Twenty-five patients who survived their admission were discharged with dietary modification. Within this group, six exhibited signs of partial recovery of their swallowing function as determined by repeated SALT assessments prior to discharge. The time to partial or complete recovery of swallowing function ranged from 2 to 30 days.

DISCUSSION

This retrospective cohort study was designed to quantify the prevalence of sepsis-associated OPD in an older hospitalised population. Any association observed will provide additional evidence that will prompt further work in this understudied area of medicine.

Our study found that the prevalence of sepsis-associated dysphagia was 16%. Of these, around 10% or 1 in 10 patients did not have any other known OPD-associated risk factors other than sepsis. This is suggestive of sepsis having a true independent association with OPD in elderly patients. This could be due to the reduced swallowing reserves in this patient group, which leaves them at a greater risk of decompensation. One potential explanation for a decompensation could be the effects of sepsis on oropharyngeal muscle function resulting in a slowing of oropharyngeal bolus transit. Skeletal and oropharyngeal muscles waste in a similar fashion with age, possibly making them more prone to dysfunction when sepsis is present. Age-related muscle wasting is thought to explain some of the increased risk of dysphagia in elderly patients. Tongue wasting and weakness with ageing has been shown to slow bolus transit and increase the risk of OPD in healthy older people. Additionally, concurrent diseases of the elderly, which cause slowed oropharyngeal bolus transit, increase the risk of OPD.[16]

Another potential explanation for sepsis causing OPD is the recognised effect that sepsis has on neuronal activity.[17 18] This (critical illness) polyneuropathy could potentially affect the highly co-ordinated sequence of neuronal activity needed to cause the sequential

contraction of swallowing musculature. Any muscular incoordination would increase the risk of OPD. Such incoordination may be particularly marked in elderly patients with a reduced swallowing reserve. It is important to note, however, that the precise effect of sepsis on neuronal firing remains poorly understood.

Fifty-one of 301 (or 16%) patients without strokes, head trauma and brain lesions developed sepsis and subsequent OPD. These patients did not have OPD prior to arriving in hospital despite the fact that the majority of them had other OPD-associated risk factors such as opiate medications, COPD, antipsychotic medication use and chronic neurological illness. This implies that these factors in isolation were not sufficient to cause OPD. Instead, sepsis plus those factors appeared to act in synergy to provoke swallowing decompensation.

Interestingly, 14 of the 33 patients who did not die during their admission exhibited full or partial recovery of OPD following the resolution of their sepsis. It can be seen that the majority (19/33) of surviving patients with sepsis and subsequent OPD did not show any signs of recovery of their swallowing function and were discharged with dietary modification. No patients were documented to have undergone swallowing rehabilitation. As swallowing rehabilitation has been shown by several studies to improve swallowing function,[19 20] the lack of rehabilitation in this study may have contributed to the low number of patients who recovered their baseline swallowing function. Further work will be necessary to highlight the observation that sepsis-related dysphagia may not be aggressively managed in the hospital setting.

Limitations

There are several limitations of this study that need to be considered. The study was retrospective in nature. As a result, although it provided a picture of what may be occurring, it does not allow incidence to be calculated. It must also be noted that although there is evidence of an association between sepsis and OPD in elderly patients, this does not imply causality. Twelve of the 51 patients with sepsis and subsequent OPD had pre-existing COPD. A study by Cvejic *et al* showed patients with exacerbations of COPD have a significant delay in their swallowing reflex.[21] This finding is thought to be due to a change between the coordination of swallowing and respiration. This is a possible causative factor for the presence of OPD in patients with COPD. However, it is interesting to note that none of the patients with pre-existing COPD who developed sepsis and subsequent OPD had any documented episodes of OPD prior to their sepsis.

Lastly, no baseline swallowing investigations were done on admission to objectively confirm the absence of any swallowing dysfunction prior to a diagnosis of sepsis and subsequently a diagnosis of OPD. No patients fulfilling the study inclusion criteria had a baseline swallowing assessment performed on admission to hospital. This is not the case for patients admitted to hospital with suspected strokes.[22] This means patients are commenced on unmodified fluids and food on admission unless they have a pre-existing diagnosis of OPD or known dietary modifications. This lack of initial assessment means potential problems are identified late. It must also be noted that OPD does not always manifest as overt swallowing dysfunction and aspiration. OPD can also cause micro-aspirations, which are more difficult to detect.[23] Indeed, 28 patients had chest sepsis, and in this patient group, there is a possibility that silent aspiration preceded their chest sepsis. However, careful review of their notes was used to identify and exclude any patients where any pre-existing dysphagia was documented. While a potential limitation, it is important to note an association between sepsis and OPD was observed in cases of non-chest sepsis.

Significance of this study

What is already known on this topic

- No studies have been performed looking at the association between sepsis and oropharyngeal dysphagia in ward-based elderly patients. Moreover, limited research has been done in this field with only one study published that showed an association between sepsis and oropharyngeal dysphagia in septic patients on an intensive care unit. In this study critical illness can be considered a confounding factor.

What this study adds

- We have demonstrated an independent association between acute sepsis and oropharyngeal dysphagia in elderly ward-based patients.

How might it impact on clinical practice in the foreseeable future

- The implication is that sepsis should be taken into account as a potential cause of oropharyngeal dysphagia in any elderly person in hospital with new-onset oropharyngeal dysphagia without other predisposing risk factors.

CONCLUSION

This study provides new data on how sepsis may be associated with OPD in elderly, non-ICU patients. Around one in six non-stroke, non-trauma patients referred to the SALT team for assessment had sepsis in association with OPD. Of these, 10% developed sepsis and subsequent OPD without any other OPD-associated risk factors. The association between sepsis and OPD should be taken into account in any new-onset aspiration event in older hospitalised patients.

Contributors Ayodele Sasaegbon planned the study, collected the data, wrote and submitted the paper. Shaheen Hamdy

helped plan the study and write the paper. Laura O'Shea provided access to the speech and language therapy database.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent Not required.

Ethics approval London Bromley research ethics committee (REC no. 15/LO/1413).

Provenance and peer review Not commissioned; externally peer reviewed.

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