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Original Paper

Analysis of Drug Prescription Patterns during Emergency Visits of Patients with Dementia at Risk of Aspiration and Choking

Fumie Yamada[1], Shusuke Uekusa[2], Yuki Hanai[2]
and Kazuhiro Matsuo[2]

[1] Department of Pharmacy, Tsukuba Medical Center Hospital,
[2] Department of Clinical Pharmacy, Faculty of Pharmaceutical Sciences, Toho University

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Abstract

Introduction: Health care for patients with dementia is becoming increasingly important in Japan's super-aged society. Emergency visits due to aspiration pneumonia and choking are on the rise, particularly among older adults. Polypharmacy complicates medication management in patients with dementia and may increase the risk of aspiration and choking.

Methods: This single-center, retrospective cohort study included 89 patients with dementia presenting with urgent choking or aspiration pneumonia. Pre-admission drug use and use of medications affecting swallowing function were analyzed. Information on drug use prior to admission was collected from the medical records.

Results: Approximately 70% of those surveyed were taking five or more drugs at any given time, while 20% used 10 or more drugs. Half of patients were using medicines known to affect swallowing function, which in many cases included antipsychotics and sleeping pills.

Discussion: Polypharmacy in people with dementia may complicate medication management and increase the risk of aspiration and choking. The frequency of use of antipsychotics and sleeping pills was particularly high, and their appropriateness needs to be examined.

Conclusion: Numerous patients with dementia arriving at the emergency department due to aspiration or choking are often on multiple medications, some of which may impact swallowing function. Thus, meticulous drug selection and management are imperative for the pharmacotherapy of patients with dementia.

Key words: swallowing dysfunction, dysphagia, dementia, polypharmacy, ageing population

Introduction

In Japan's super-aged society, healthcare for patients with dementia is becoming an increasingly urgent concern. Among older adults, a rising number of patients with dementia seek medical help at hospitals, often due to complications such as aspiration pneumonia or choking[1,2]. This trend may be influenced by the inclination of older individuals to utilize multiple prescription medications for managing chronic conditions and age-related symptoms[3].

Owing to the need to address chronic conditions and age-related symptoms, polypharmacy poses challenge in patients with dementia. The consequently greater likelihood of adverse events complicates medication management. Of particular relevance are medications that may potentially impact swallowing function, thus elevating the risk of aspiration and choking. However, the direct causal relationship between aspiration and adverse drug events remains to be firmly established.

This risk may be further exacerbated in patients with dementia, which is often complicated by progressive dysphagia. Effective drug management becomes even more imperative for patients of certain social backgrounds and those with specific medical requirements.

Given these challenges, we conducted an extensive examination of drug utilization among older adults with dementia who presented with critical conditions stemming from aspiration or choking at a suburban emergency hospital. Despite the growing number of reports on polypharmacy, there remains a paucity of studies on

連絡先：植草秀介　〒 274–8510　千葉県船橋市三山 2–2–1　e-mail：shuusuke.uekusa@phar.toho-u.ac.jp

drug-induced aspiration and choking. Hence, we focused on dysphagia to delineate drug use associated with this condition.

Methods

This retrospective cohort study was conducted at a single center.

The study included patients aged ≥ 65 years with dementia who visited a suburban emergency room due to aspiration pneumonia or choking between April 1, 2017, and March 31, 2022. Clinical information used for the analysis was collected retrospectively from the medical records. Information on sex, age, length of hospital stay, place of residence prior to admission, major comorbidities affecting swallowing function, laboratory values (serum albumin level and estimated glomerular filtration rate), swallowing function before admission, and medications used before admission was obtained. Diagnoses and comorbidities at admission were extracted based on the International Classification of Diseases, 10th edition, as registered in medical records. Pre-admission feeding and swallowing functions were assessed using the Functional Oral Intake Scale (FOIS)[4] based on the patient's usual food intake, with information collected from the medical information form or by the nurse interviewing the caregiver. The medication history prior to admission was primarily documented by the pharmacist, utilizing both the 'drug profile book' (a brief and comprehensive notebook containing the patient's medication history for review by healthcare providers) [5] and the 'medical information form' (documentation of a summary of medical treatment to date, including symptoms, diagnosis, and treatment) used between facilities at the time of admission. Patients or caregivers were interviewed to gather information regarding medication usage. This encompassed both oral and external medications intended for systemic action (e.g., inhalers, suppositories, and patches) that were used consistently for at least four weeks prior to admission. Medicines that were not used regularly and external medicines intended for local action were excluded. The classification of medicinal products is based on the Japanese Ministry of Health, Labour and Welfare drug classification codes[6]. The current study focused on medicines that affect swallowing function and investigated their use. Based on the 'Guidelines for medical treatment and its safety in the elderly 2015' by the Japan Geriatrics Society[7], 11 drug classes (antipsychotics, benzodiazepines, non-benzodiazepines, tricyclic antidepressants, sulpiride, Parkinson's disease drugs, oxybutynin, muscarinic receptor antagonists, H_1 receptor antagonists, H_2 receptor antagonists, and antiemetics) were registered. These medications have been associated with 'serious side effects,' including cognitive decline, dry mouth, extrapyramidal symptoms, and aspiration. Given their potential impact on the five stages of swallowing, caution should be exercised when administering them.

Patients who were on nutritional therapy other than oral intake prior to admission (FOIS < 4), those who died during admission, and those with missing information were excluded (Fig. 1).

The statistical software Easy R Ver. 1.55 (for Windows standard, produced by Jichi Medical University

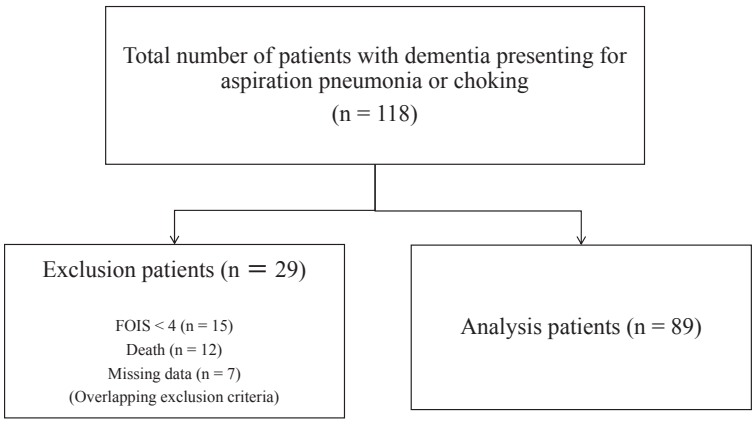

Fig. 1　Patient selection flow.
The patient selection process is shown: 118 patients were enrolled, and 29 patients who met the exclusion criteria were excluded from the study. These included 15 patients with a swallowing function FOIS < 4, 12 patients who died during hospitalization, and seven patients with missing data. Some patients met multiple exclusion criteria.

Saitama Medical Center)[8] was used for the statistical analysis of categorical and continuous variables were analyzed.

Results

1. Baseline characteristics

Eighty-nine patients (51 males and 38 females) with a mean (± standard deviation) age of 86.3 ± 6.6 years were included in the study. Complications included cerebrovascular disorders (32 patients), psychiatric disorders (four patients), and other brain diseases (diseases of the cranial nervous system, excluding dementia and cerebrovascular disorders) (three patients). Before admission, 51 individuals (57.3%) resided in a nursing home, while 37 (43.8%) lived at home. Additionally, 72 patients (81.1%) exhibited albumin levels below 3.5 g/dL, signifying more than mild nutritional impairment. Seventy-three percent of all patients had swallowing function below FOIS 7 before admission, indicating that most required some modification of their daily diet (Table 1).

2. Summary of drug use

The mean number of drugs used by eligible patients was 6.6 (standard deviation 3.6), with 18 drugs being the highest number used. While there is no universally accepted definition of polypharmacy, we adopted the criterion of using more than five or ten drugs, as it has been commonly employed in previous studies[9]. Sixty (67.4%) used more than five drugs, 18 (20.2%) used more than 10 drugs (Table 1, Fig. 2-1), and 42 (47.2%) used drugs affecting swallowing function (Table 1, Fig. 2-2). Thirty-seven (41.6%) patients used five or more drugs, including drugs that affected swallowing function. According to a survey, 587 drugs were prescribed to 89 eligible patients. Overall, 'other drugs acting on the central nervous system' (75 drugs), including antidementia drugs, were used the most, followed by antacids (48 drugs), anti-peptic ulcer drugs (47 drugs), vasodilators (41 drugs), antipsychotics (35 drugs), other drugs acting on the genitourinary and anal systems (30 drugs), and hypnotic sedatives (21 drugs), including benzodiazepines and non-benzodiazepines (Fig. 3).

3. Use of drugs affecting swallowing function

With regard to drugs affecting swallowing function, benzodiazepines and non-benzodiazepines, sleeping pills (20 patients), and antipsychotics (18 patients) were used and prescribed more frequently (Fig. 4).

4. Use of antipsychotics

The atypical antipsychotics risperidone (9 patients) and quetiapine (8 patients) were most commonly used,

Table 1　Baseline characteristics.

Number of cases, *n*	89
Sex, male:female, *n*	51:38
Age, mean ± SD; median; range	86.3 ± 6.6; 86; 68–101
Length of hospital stay, mean ± SD; median; range	32.6 ± 2.5; 25; 2–128
Resident of, *n* (%)	
Own home	37 (43.8%)
Nursing home	51 (57.3%)
Hospital	1 (1.1%)
Comorbidities, *n* (%)	
Cerebrovascular disease	32 (40%)
Psychosis	4 (4.5%)
Other brain disease	3 (3.4%)
Swallowing function	
FOIS, mean ± SD	5.5 ± 1.1
Level (4/5/6/7), *n* (%)	23 (25.8%)/24 (27.0%)/18 (20.2%)/24 (27.0%)
Laboratory test value, mean ± SD	
Alb (g/dL)	3 ± 0.5
eGFR (mL/min/1.73 m^2)	61.8 ± 22.8
Number of drugs usually taken, *n* ± SD	6.6 ± 3.6
Use of 5 or more drugs, *n* (%)	60 (67.4%)
Use of 10 or more drugs, *n* (%)	18 (20.2%)
Use of drugs that affect swallowing function, *n* (%)	42 (47.2%)

The profile of the 89 patients included in this study is presented.
Gender, age, length of hospitalization, pre-admission residence, comorbidities, swallowing function (FOIS), laboratory values (albumin, eGFR), and pre-admission medication use are shown.

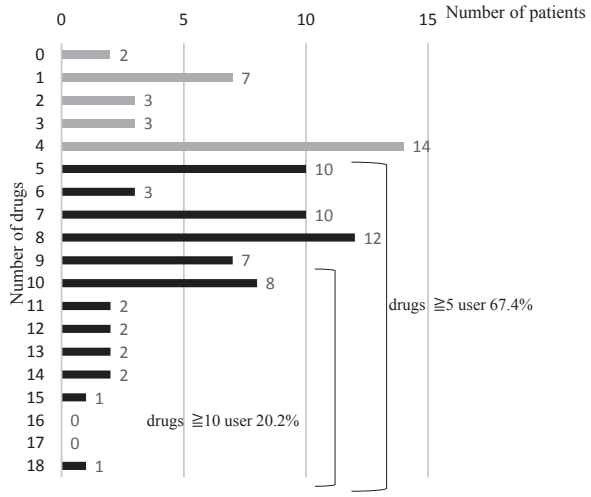

Fig. 2-1　Total number of medications used prior to admission and number of patients.
67.4% of patients used more than 5 drugs, and 20.2% used more than 10 drugs. The largest number of drugs used by a patient was 18. The vertical axis is the number of prescriptions per patient, and the horizontal axis is the number of patients.

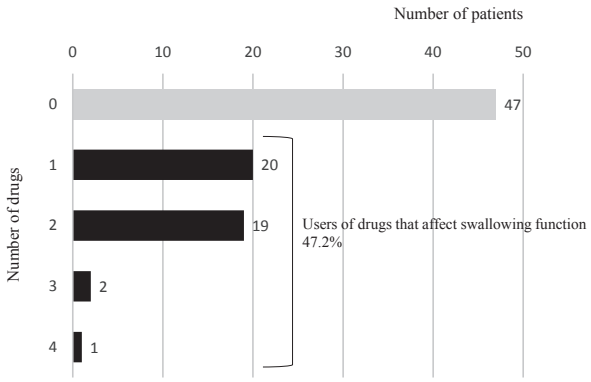

Fig. 2-2　Number of prescriptions and patients receiving drugs that affect swallowing function.
The following table shows the use of 11 drugs that affect swallowing function according to the guidelines of the Japan Geriatrics Society. The vertical axis is the number of prescriptions per patient, and the horizontal axis is the number of patients.

Fig. 2　Prescription status of eligible patients prior to admission.

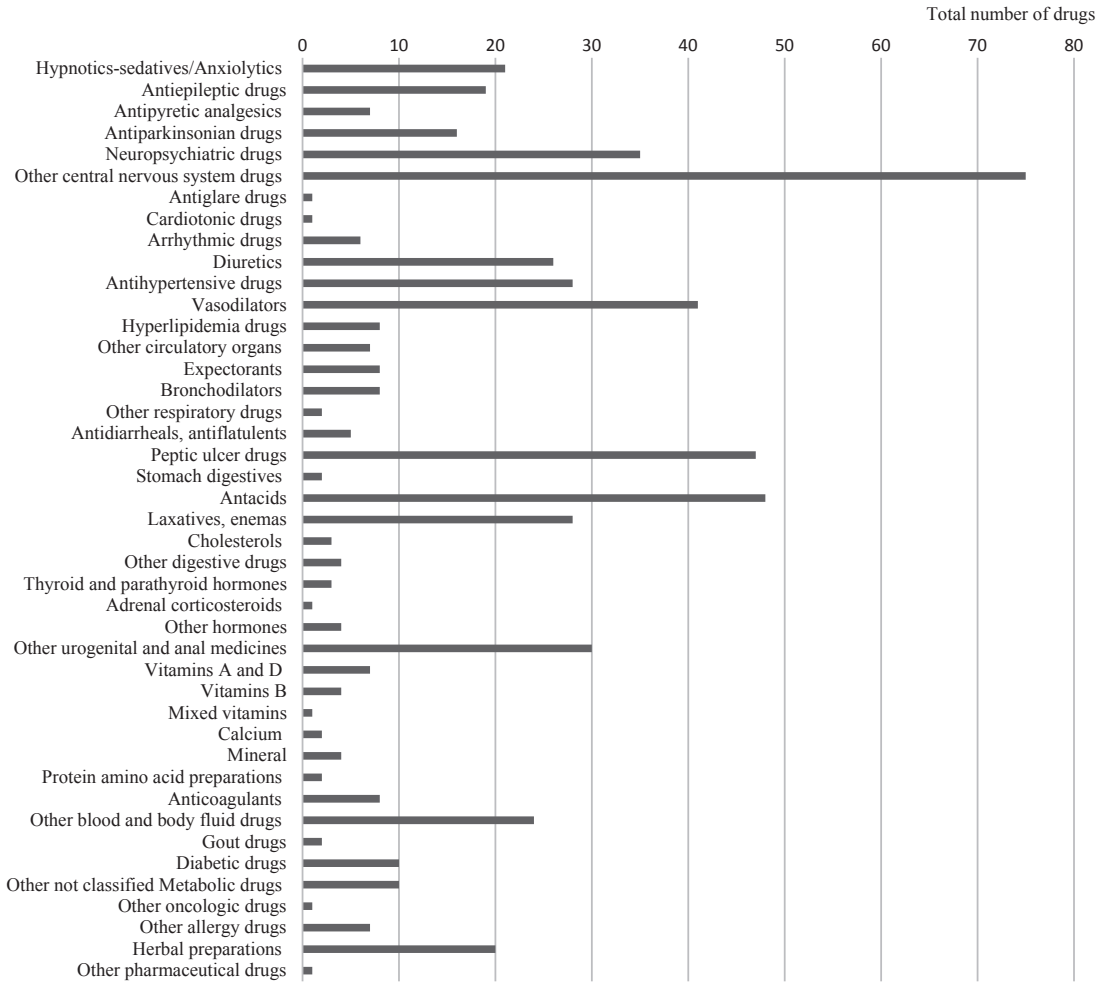

Fig. 3　Total number of drugs by classification of medicinal products.
Shown is a breakdown of all drugs prescribed prior to admission. Vertical axis is drug type. Based on Japanese Ministry of Health, Labour and Welfare drug classification codes. The horizontal axis indicates the total number of drugs.

although some patients (5 patients) used typical antipsychotics (Fig. 5–1). Ten patients required less than 50 mg chlorpromazine equivalent per day, while eight required more than 50 mg chlorpromazine equivalent. The highest dose required by a patient was 275 mg chlorpromazine equivalent (Fig. 5–2). In this study, none of the patients who used antipsychotics had any psychiatric comorbidities.

5. Use of sleeping pills

Of the eligible patients, 29 were taking medication for insomnia. This corresponded to 32% of eligible patients. In terms of drug-specific use, most patients used the orexin receptor antagonist suvorexant (7 patients) and the benzodiazepine sleeping pill brotizolam (6 pa-

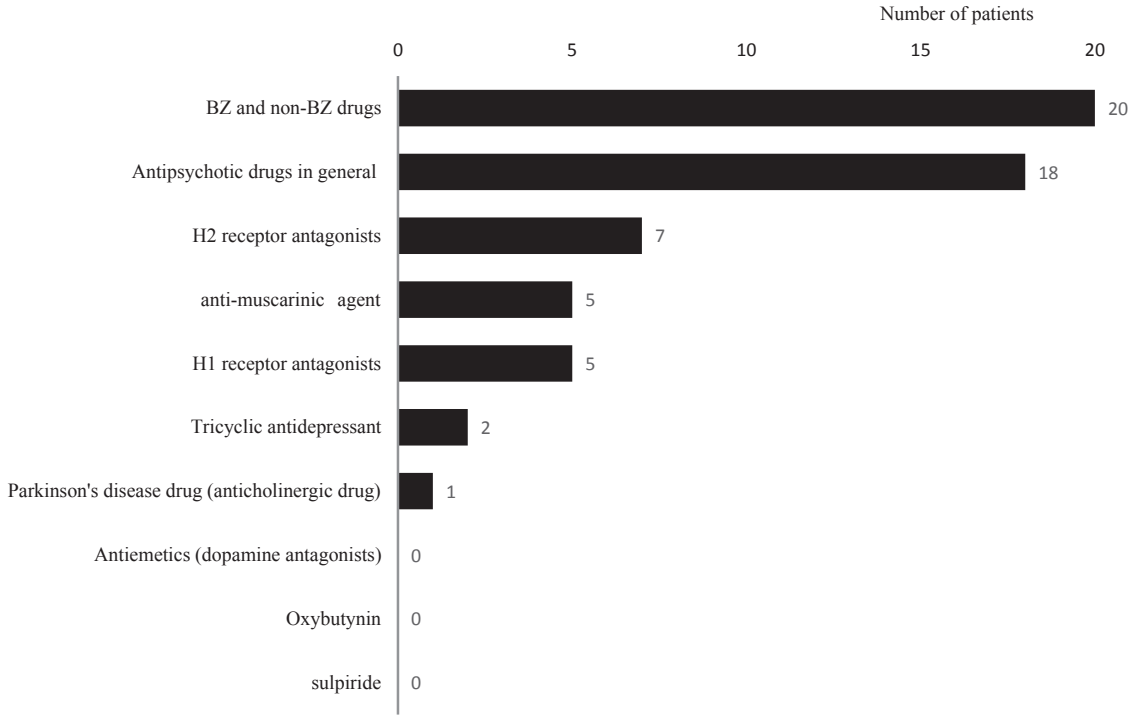

Fig. 4　Details regarding the use of drugs that affect swallowing function.
The vertical axis indicates the type of drug. Benzodiazepines and non-benzodiazepines are shown together. The horizontal axis represents the number of patients.

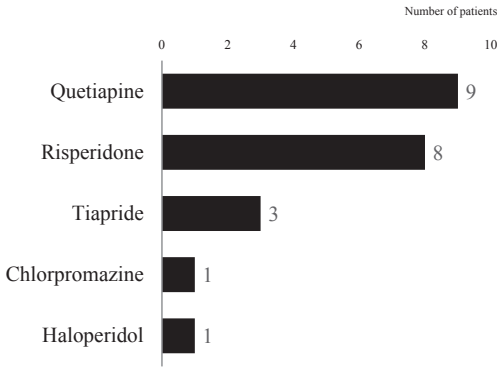

Fig. 5-1　Number of patients using antipsychotics.
Prescription status of each antipsychotic. The vertical axis indicates the drug name, and the horizontal axis indicates the number of patients.

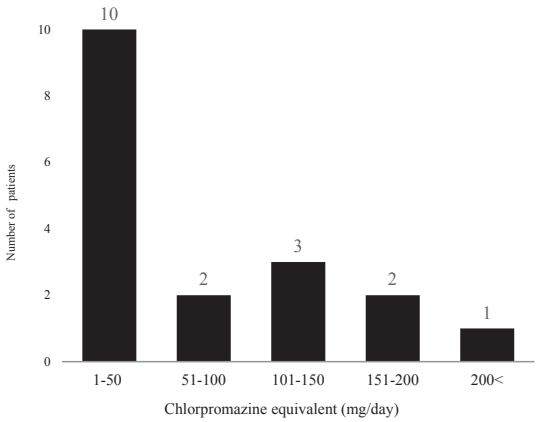

Fig. 5-2　Daily dose of antipsychotics.
The horizontal axis indicates the amount of chlorpromazine used per day. The vertical axis indicates the number of patients.

Fig. 5　Antipsychotic medication use.
The vertical axis indicates the type of drug. Benzodiazepines and non-benzodiazepines are shown together. The horizontal axis indicates the number of patients.

tients) (Fig. 6-1). Benzodiazepines and non-benzodiazepine sleep medications were the predominant types of medication used on a per-patient basis, with some patients using more than one simultaneously. Novel drugs for insomnia (melatonin receptor agonists and orexin receptor antagonists) were used by approximately 30% of patients (Fig. 7). Most daily doses of benzodiazepines and non-benzodiazepines were less than 5 mg diazepam equivalents, although some used more than 10 mg diazepam equivalents. The highest dose required by a patient was 15 mg diazepam equivalent (Fig. 6-2).

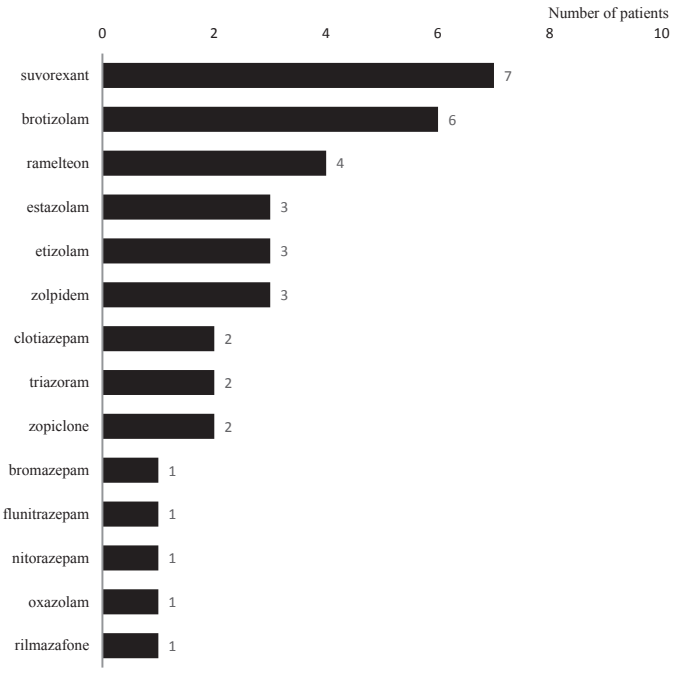

Fig. 6-1　Prescription status of sleeping pills and insomnia medications by drug type.
This chart shows the use of benzodiazepines, non-benzodiazepines, melatonin receptor agonists, and orexin receptor antagonists by drug type. The vertical axis indicates the drug name, and the horizontal axis indicates the number of patients.

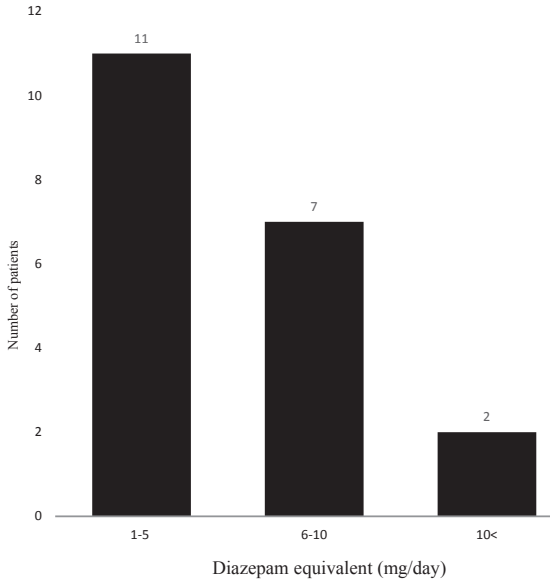

Fig. 6-2　Daily dose of benzodiazepines or non-benzodiazepines.
The per-patient use of benzodiazepines and non-benzodiazepines is shown. The horizontal axis indicates the amount per day, converted to diazepam use. The vertical axis indicates the number of patients.

Fig. 6　Insomnia medication use.
This is a breakdown of the use of sleeping pills and insomnia medications.

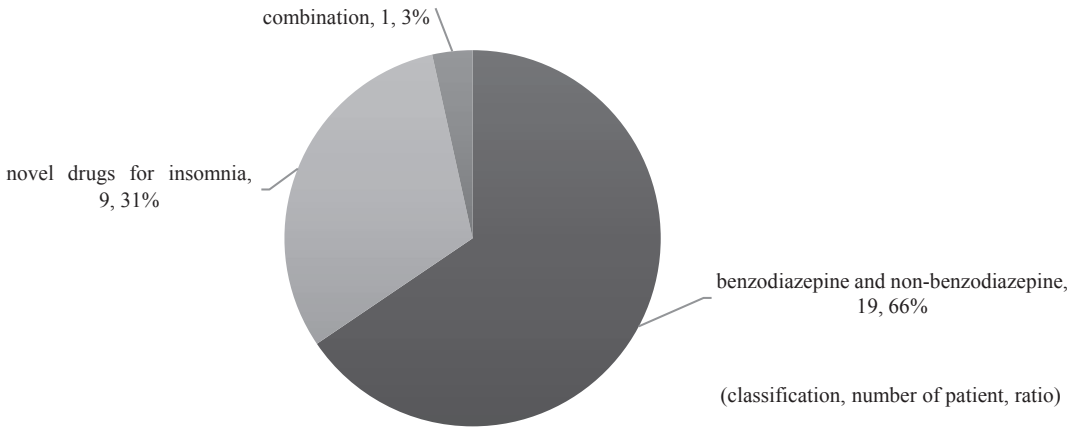

Fig. 7　Medications for insomnia.
The use of drugs affecting swallowing function (benzodiazepines and non-benzodiazepines) or drugs with novel mechanisms of action (melatonin receptor agonists, orexin receptor antagonists) is presented. Drug classes, number of patients, and percentages are listed in this order.

Discussion

In the present study, polypharmacy was suspected in many patients with dementia presenting to the emergency room due to aspiration pneumonia or choking. Approximately 70% of patients were using five or more medications at any given time, half of which affected swallowing function. This observation was in line with previously reported polypharmacy studies[10,11]. Some patients in the present study already had impaired swallowing function, and the others were expected to develop dysphagia in the future. Furthermore, this is a group that may have oral frailty due to old swallowing or poor nutrition and that is predisposed to dysphagia in the first place. The undesirable pharmacologic effects of some drugs on swallowing function may not generally be considered very serious; however, for those with frail swallowing function, they are important as they affect eating and thus further worsen the nutritional state, setting off a negative chain of events. This can also lead to various problems, such as prolonged hospitalization and burden of care[12]. Such adverse effects on swallowing function can sometimes lead to disastrous outcomes, such as choking. People with dementia may exhibit abnormal eating behaviors such as hoarding and stuffing, poor concentration (while chewing, moving on to the next action, or starting to talk, etc.), and heterophagia[13]. Swallowing food after inadequate mastication increases the risk of choking[14,15]. For example, a dry mouth with decreased saliva production reduces food lubrication, which may result in inadequate food mass formation.

Although this study does not show a direct causal relationship between emergency visits due to aspiration or choking and adverse drug events, it does show that these patients routinely receive medication that may increase their chances of an emergency visit, which should be taken seriously.

The breakdown of medications showed a high frequency of use of "antacids," "anti-peptic ulcer medications," "vasodilators," and "drugs acting on the urogenital and anal systems," which was similar to the trends in other polypharmacy studies[16~18]. This is indicative of conditions specific to the elderly, such as diseases of the digestive system, cardiovascular disease, and abnormalities of elimination. Some patients, however, may have additional prescriptions to control adverse events from other medications. For example, some were prescribed peptic ulcer medications along with analgesics, anticoagulants, and other drugs that can cause gastrointestinal problems. Meanwhile, "other drugs acting on the central nervous system," "antipsychotics," and "hypnotic sedatives" may be characteristic results for this group, as anti-dementia drugs play a leading role in their treatment. Further, antipsychotics and hypnotic sedatives are increasingly used as adjuncts to reduce agitation and delirium. Thus, patients with dementia require a greater variety of medications than those without dementia. However, a patient's swallowing function may limit the number of medications they can swallow. In light of this, swallowing function and treatment priorities should be considered.

Among medications that affect swallowing function, "benzodiazepines and non-benzodiazepine hypnotics" and "antipsychotics" are used more frequently, indicating that many patients with dementia require them. However, whether these should be used continuously remains a matter of debate.

The sedative effects of these agents are effective in reducing the agitation characteristic of dementia, while the major adverse event, extrapyramidal disturbances, may also affect swallowing function. Control of their agitation also requires environmental modifications, adjustments in pharmacotherapy and non-pharmacological treatment options should also be considered. In recent years, the use of atypical antipsychotics, which are considered to have fewer extrapyramidal adverse events, has become more common than that of typical antipsychotics. The same was true in this patient group. Most were adjusted to less than 50 mg chlorpromazine equivalent per day, with some using higher doses. However, even atypical antipsychotics are not without the risk of dysphagia and should be used with caution[7,19].

Novel drugs for insomnia, such as melatonin receptor stimulants (e.g., ramelteon) and orexin receptor antagonists (e.g., suvorexant and lemvorexant), have recently been introduced to the market. Although most patients were using suvorexant and ramelteon, a larger percentage of patients were using benzodiazepines and non-benzodiazepines. Benzodiazepines and non-benzodiazepines are drugs with safety concerns for the elderly and should be used with caution[7]. Thus, safer treatment options should be considered when available.

Why are so many medications prescribed to patients at risk for dysphagia? A survey in the United Kingdom

reported that only a small percentage of patients who are aware of their medication difficulties discuss them with their health care providers, and only a small percentage of health care providers ask patients about their difficulties with medication intake[20]. Thus, medication dysphagia may be underestimated and patients may be forced to take excessive amounts of medication. Forcing them to take something they are not able to handle will increase the risk of aspiration and choking. Chemical residues in the passage route may cause mucous membrane damage. If a medication is difficult to swallow, some may not adhere to it or process it to make it easier to swallow. However, not all patients report or discuss this fact with the person providing the medication. There is not enough understanding among the community about the possible harmful effects of improper processing of medicines[20,21]. Failure to take medication is another factor that can trigger adverse drug events[21], even if difficulty taking the drug is the reason for skipping.

All drugs are prescribed because they are needed by the patient, but patients with dysphagia are limited in the amount and form they can swallow. An assessment of swallowing function and prioritization of medications should be considered during prescription. Further, we should recognize that the current results are just the tip of the iceberg and that there are many potential patients in the community who are receiving drug therapy while at risk of aspiration.

There are several limitations to this study. First of all, the study was conducted at a single medical institution. The collected data were continuous, and bias was minimized to improve the reliability of the study; however, there was a lack of information on the classification and severity of dementia, which is considered useful for characterizing drug therapy and dysphagia. Because most patients were not primary doctors, it was necessary to obtain patient histories and other information from other hospitals; however, the depth of information was insufficient with regard to the course of medical history and the reason for and history of current drug therapy. Many of the cases were serious, requiring life-saving treatment or systemic management, and emergency room treatments typically do not encompass the treatment of dementia. Therefore, it is not definite whether the results of this study can be widely applied to patients with dementia. Future research should collect data from multiple medical institutions and conduct a comprehensive analysis that takes into account regional and institutional differences, as well as classification and progression of dementia. Second, drug use information was verified by pharmacists based on the 'drug profile book' and the 'medical information form.' Wherever possible, measures were taken to improve the reliability of the data, such as by interviewing patients and caregivers to investigate usage in greater detail. However, the 'drug profile book' in particular is left to the patient's control, and missing information cannot be ruled out. In the future, a system for collecting drug information using personal identification numbers may be put in place to provide more accurate information.

Conclusion

In the present study, we investigated the prescriptions of patients with dementia who presented to the emergency department due to aspiration or choking. Dementia patients normally use various medications, some of which affect swallowing function, even though they may have impaired swallowing function. While we cannot determine whether an adverse drug event was the trigger for an emergency visit, we should be concerned whether a patient is routinely receiving high-risk medications. Therefore, we need to be more considerate of the ability of dementia patients to take their medications and plan prescriptions accordingly.

Statements and Declarations

Ethics approval

This was a single-center retrospective cohort study. The study protocol was approved by the Ethical Research Committee of Tsukuba Medical Center Hospital (approval number: 2022–006).

Availability of data and materials

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare no conflicts of interest in association with the present study.

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