問：　東日本大震災における停電時に在宅酸素療法患者はどう過ごしましたか。

回答：81.5%が治療継続上推奨される「酸素ボンベの切り替え」（切り替えようとした23人含む）ができていました。このうち入院したのは43%であり、半数近くは避難先が病院でした。酸素処方時間が長い、酸素処方流量が多いほど有意に酸素ボンベへの切り替えができている傾向を認めました。
入院の有無により比較すると、入院した群の方は合計処方時間が長く、2L機種よりも7L機種を使用する患者が多くありました。呼吸器疾患患者に絞って検討したところ、入院に影響したのは7L機種を使っているか否かでした。

問：　東日本大震災の際の計画停電による医療施設への影響はどのようなものがありましたか。また在宅酸素療法患者および在宅人工呼吸患者はどのような影響を受けましたか。

回答：施設への調査によると、病院の設備利用の制限、外来機能の制限、病院業務の増加・職員の疲弊、給食の供給、病院業務に多岐にわたる影響をきたしていました。在宅酸素・在宅人工呼吸療法実施患者に対しては18%が影響ありと回答し、患者の病院・酸素業者への問い合わせ、不安の増加、機器や酸素ボンベの使用制限、救急受診・緊急入院などがあげられました。患者対応に関しては、患者からの問い合わせ、緊急入院・救急受診があった。患者に対して計画停電に対する事前対応をしていた施設は35%でした。
緊急対応に対する見直しを行った施設は22%のみであり、見直しの内容は、災害マニュアルの新たな作成、在宅酸素・在宅人工呼吸療法実施患者の災害時のマニュアルの見直しがあげられました。

問：　東日本大震災被災地の在宅酸素療法患者はどのようにして情報を得ていましたか。

回答：被災した在宅酸素療法患者による調査では、震災直後にHOTに関する情報提供を受けていたのは全体の75%でした。そのうち60%は酸素業者の直接訪問を受け、27.7%が電話で、6.2%がラジオから情報を得ていました。今後の震災時にふさわしい情報伝達手段としては対象患者の84.6%がラジオと回答していました。同じ問いに対して訪問看護師、ケアマネージャーについてはラジオ以外に電子メールやインターネットといった回答も目立ちました。

問：　東日本大震災の経験から医療における防災対策の問題点は何ですか。

回答：平成24年度の防災白書によれば、急性期医療の対応については体制整備が図られていましたが、慢性疾患への対応や、想定よりも長期間の活動が必要であり、医療チーム間の引き継ぎが十分でない事例があったと報告しています。実際、COPDの急性増悪、喘息の重症発作、肺炎の増加あるいは在宅酸素療法（HOT）患者の電源や予備酸素ボンベの確保などの必要が生じ多くの医療現場が混乱した。災害の急性期・亜急性期では高齢者の呼吸器疾患が問題となっている。また呼吸器疾患の患者団体からも大災害時の対策が大きな不安であることが常々言われていた。

問：　災害時に情報を提供する手段として望ましいものは何ですか。

回答：災害・緊急ラジオの積極的な利用が望ましいと考えられましたが、事前に周知しておく必要があります。
また、災害備品としてラジオ，電池，簡易型の発電機・充電器などの準備を促す必要もあります。

《公助・共助》

問：　慢性呼吸器疾患患者では災害時にどの程度の患者に援助が必要でしょうか。

回答：災害時に援助を常に必要としている患者は 49.5%であり、必要なしと回答した患者は 19.2%でした。軽症患者においては 30 名が常に援助を必要としており、最重症患者で援助の必要なしと回答した患者はいませんでした。

問：　HOT 患者は自治体の災害時要援護者の対象でしょうか。

回答：在宅酸素療法患者が災害時要援護者の対象となっていると答えたのは 74%、このうち、在宅酸素療法患者と明記してあるのは全体の 8.6%で、そのほかは特定の基準を満たせば対象とするとの返答でした。対象者基準として介護保険の要介護度、身体障害者手帳の等級、高齢世帯や高齢独居など手上げ制度での登録や難病患者であることなどがあげられました。

また、HOT 患者が要援護者の対象となっていない自治体について、今後の計画を尋ねたところ、64%が対象とする計画はないと回答しました。

松本市は災害時医療救護活動マニュアルが作成済みで、在宅酸素患者は災害時要援護者として明記されており、「在宅酸素取扱事業者は災害発生時、受持ち患者の在宅酸素発生器の稼働状況をチェックし、速やかに在宅酸素機材を患者の自宅や避難所の指定場所に搬入する」とあります。災害時要援護者登録制度により在宅酸素患者は他の要援護者と区別して登録され、現在約半数強が登録されています。災害要援護者の対象は HOT 患者・児の他に、身体障害者、要介護 3～5、難病、妊婦、乳幼児などの約 83,000 人が対象となり、その内、H26 年 2 月現在までに登録されている対象者数は HOT 以外の災害要援護者を含めると約 9,900 人で、HOT 患者の登録は約 1 割と報告していました。他の自治体に先駆けて在宅酸素患者の対応が示されているが、個人情報の管理と開示および災害時の具体的な導線といったいくつかの問題点と課題が指摘されました。

問：　自治体はどの機関・組織と HOT 患者の避難支援計画として連携を取っているでしょうか。

回答：役所の身体障害者関連統括部が一番多く 74%でした。一方、災害時に酸素を届ける役割を担う酸素業者を連携先として挙げている自治体はわずかに 7%にとどまりました。

問：　災害時の HOT 患者に対する対応として、どのようなものが考えられますか。

回答：松本市は医師会、歯科医師会、薬剤師会、広域消防局の協力のもとに平成 18 年災害時医療救護活動マニュアルを作成、平成 23 年に改定版、H25 年松本広域圏災害時医療連携指針に至っています。HOT 患者に対しては、酸素流用が 3ℓ未満の場合は HOT センターへの誘導、医療救護所での対応を、3～5ℓ以上の高流量の場合は、予め案内された医療機関の対応とするなどの、程度別の対応の場作りが考えられています。

問：　地域医師会では、緊急時に在宅医療を受けている患者の情報が共有できるネットワークの構築はできていますか。

回答：現在、体制が構築されているのは 6.4%であり、ほとんどの医師会でネットワーク構築が遅れていた。また現在構築されていない地域における今後の予定は、具体的な予定ありは 5%、具体的予定はないが検討中は 48.1%、予定なしが 29.8%でした。

問：　平時からの対策として何が必要でしょうか。

回答：非常時にも備えた患者管理・サポート体制の構築が必要です。これは国が防災の基本理念として挙げています。国民一人ひとりや企業が自らの命、安全を自ら守る「自助」、地域の人々や企業、ボランティア、団体などが協働して地域の安全を守る「公助」をどのように慢性呼吸器疾患の患者に適用するかという目標に合致するものです。

問：　慢性呼吸器疾患、HOT 患者支援のための公的な精度は整備されていますか。

回答：災害時の要援護者支援制度はようやく、自治体での整備が義務化されたところであり、まだ慢性呼吸器疾患、HOT 患者の実情が周知されておらず、配慮されているとは言えない状況です。患者団体、呼吸器関連学会と供に社会的なアピールをもっと強く続ける必要があります。

問：　患者情報共有システムの整備はどのように進めるべきでしょうか。

回答：災害に強い情報網の整備、これに伴い扱われる個人情報管理のセキュリティと利便性の両立が求められます。普段からの患者情報をどこまで共有できるかが課題であるが、既に平成 25 年に防災対策基本法改正に伴い緊急時の個人情報開示が認められており今後はこれに従って、患者の事前承諾で情報共有を進めていくべきです。このためには医療機関、酸素業者とも制度を良く理解し患者に自治体における支援制度の確認、事前登録を勧めていく必要があります。

今後開始されるマイナンバー制度は災害対策にも利用される予定と言われていますが、ここに医療情報を統合して情報管理していくことが、安全性、利便性の点ではもっとも適切であろうと推察されます。

《酸素事業者》

問：　酸素事業者は機器や担当患者の情報をすぐに把握できますか。

回答：機器を一元管理してすぐに状況を把握できると回答した業者は全体の 62%でした。19%は機器の情報管理が実施されていませんでした。12%の事業者は災害時に担当患者の把握ができない状態であることが判明しました。また、個人情報関連については多くの事業者が規約を持たない状態でした。

問：　酸素事業者は 24 時間対応できる体制を整備できていますか。

回答：24 時間連絡・対応できるコールセンターや窓口の設置状況について、76%は一定の窓口を設け一括対応を可能としていましたが、19%の事業者は患者の担当者個人にすべて任されている状態でした。

問：　HOT 事業者は災害時に備えた機器等の備蓄、物流体制の整備はできていますか。

回答：災害時に備えた酸素ボンベ、機器の備蓄・供給システムについて、多くは携帯ボンベの備蓄体制を取っていましたが、実際の物流体制になると半数に減っており、物品は確保できても、配送不能という事態に陥る可能性が示唆されました。

問：　HOT 事業者は災害時に備え自治体等の地域の組織との連携体制を構築していますか。

回答：自治体との連携を構築している事業者は 22%だけで、事業者の 63%は地域で特別な連携を構築してい

ませんでした。契約医療機関との間で緊急時や災害時に関しての事前協議を実施していたのは 57%でした。

問： 酸素事業者による緊急時の個人情報開示に関する規約はありますか。
回答： 64%の業者は規約を整備していませんでした。

問： 酸素事業者は地域自治体との連携体制を整備していますか。
回答： 71%は自治体との連携体制は持たない状況でした。

問： 酸素事業者は契約医療機関との災害時連携についての事前協議をしていますか。
回答： 43%で事前協議は実施されていませんでした。

問： 災害時のための対策として、酸素事業者はどのようなものを求めていますか。
回答： ①災害時、地域毎の HOT センターの設置、②車両運行の確保と関連する行政の適時対処、③災害時協定に基づく費用負担の保証

問： 災害時のための対策は酸素事業者がすべて負担するのでしょうか。
回答： 業者にばかり負担をかけ過ぎないような，事前協議，特に費用まで含めた実務的な取り決めが必要です.

問： 酸素業者による情報管理体制の現状はどうなっていますか。
回答： 多くの業者で患者情報の一元管理がなされている反面、一部の業者は管理体制が追いついていない状況です。一部は情報管理が担当者任せとなり、全体としての情報共有がなく災害時には極めて問題となる体制です。これは平時の患者サービスについても同様であり、業者による管理・サービス体制のさらなる質の向上と均てん化が求められます。業者間内での情報共有、震災対応の連携なども積極的に進める必要があります。

問： 災害時の酸素業者と医療機関の連携体制は整っていますか。
回答： 事前協議による手順確認が必要であり、特に平時から患者対応を業者に依存しがちな医療機関は保険管理上も問題が大きいため、早急に管理体制を改めるべきです。患者の求めるサービスの質を医療機関の都合で犠牲にすべきではありません。HOT の保険制度上もより厳格な管理体制を求めるべきです。

問： 酸素業者はどのように関わっていくべきでしょうか。
回答： 災害時の重要な役割にも拘わらず、酸素業者の役割が周囲にあまり認知されていません。災害対策は医療機関だけでは進められないことを認識し、積極的に自治体との連携を進め、所定の取り決めを整備すべきです。

《患者会から》
問： 災害時のための患者会として、患者会はどのようなものを求めていますか。

回答：① HOT センターの設置

あらかじめ HOT 患者を支援・収容する HOT センターを設置する医療機関（都立・県立病院など）を決めておけば、業者は交換用酸素ボンベの緊急配備でき、患者・家族はボンベを交換する事ができます。患者の不安感を取り除くことができ，精神的な安心感が持てます。また、患者の安否確認連絡が取りやすくなります。医療者の手配・派遣、医薬品の手配、事業者間・マスコミとの連携もスムースになります。

②「災害時要援護者の避難支援ガイドライン」の見直し

現状は「身体障害者 2 級以上，介護保険の要介護度 3 以上」ですが、在宅酸素療法，在宅人工呼吸療法を行っている在宅の難病患者に対して，病院への運搬ないし避難所への誘導などに関し，具体的な避難計画基準の策定を促してほしい。厚生労働省として，総務省および地方公共団体へ改善検討の示達をお願いしたい.

（資料）災害時のアクションプラン

地震などの災害時の対応のため平時より準備をして，災害時に対応できるようにしましょう．

すべての患者さんへ

運動

- 災害時の避難生活などを見据えて，平時から身体を動かし，足腰の筋力を強化しましょう．
- 災害直後などは避難所生活などで，身体を動かす機会が減ります．活動量の低下は，肺塞栓症や肺炎，COPD 増悪を起こす原因になりますので，体操やストレッチ，可能であれば散歩を行うようにしましょう．

呼吸トレーニング

- 口すぼめ呼吸は，息苦しさの緩和などによる精神的な安定にも繋がります．災害時に実施できるように，平時からトレーニングしておきましょう．

薬剤

- 災害時には，病院や薬局の機能停止から処方が受けられなくなる事が予測されます．避難用品として 2～4 週間分の，吸入薬などのくすりを準備しておきましょう．
- 避難先の医療機関や薬局で処方が受けられるように，ICON 手帳やおくすり手帳を常に携帯するようにしましょう．

感染予防

- 災害時には，劣悪な環境で過ごす事を余儀なくされ，感染症などに罹る恐れがあります．マスク装着・うがい・口腔ケア，手洗いなどを行い，感染予防に努めましょう．

居宅の地震対策

- 家具の固定や高所の物品の落下防止などの対策を行いましょう．
- 各自治体での避難場所や避難経路を確認しておきましょう．
- 「津波てんでんこ」，家族で落ち合う場所を決めておきましょう．

一般的な避難用品の準備

●2-3 日分の食品や飲料水	●マスク	●くすり	●ラジオなどの情報源
●携帯電話充電器	●携帯用トイレ	●衣類や毛布	●懐中電灯

在宅酸素療法を実施中の患者さんへ

平時の準備

- 酸素ボンベは，落下や破損しない安全な場所に保管しましょう．
- 酸素ボンベ１本で何時間もつかを確認し，８時間以上の酸素ボンベを自宅に保管しておきましょう．
  （＿＿＿＿＿）本
- 停電に備えて，枕元や酸素濃縮器のそばに懐中電灯を常備しておきましょう．
- 緊急事態に備えて，酸素濃縮器や酸素ボンベの使用方法を，家族や身近な人とも確認しておきましょう．
- 呼吸同調器を使用中の方は，予備の乾電池を準備しておきましょう．

災害時の対応

- 停電の場合は，酸素濃縮器から携帯用酸素ボンベに切り替えます．液体酸素を使用中の方は，親器・子器のどちらを使用しても問題ありません．
- あわてずに呼吸法を行い呼吸を整えて，下記の指示に従って酸素消費量を節約します．
- 電源の確保が難しい場合や酸素業者との連絡が取れない場合は，近隣で電源を確保できる場所や病院へ避難しましょう．

災害時の酸素流量		
安静時	L/分	} に減量します
労作時	L/分	
就寝時	L/分	

酸素業者との連絡

- 可能であれば電話連絡し，現状報告や避難先を伝え，ボンベの手配などを依頼しましょう．
- 連絡できずに避難する場合は，自宅の外壁や郵便ポストに酸素業者に宛てた，避難先や連絡先を明記した張り紙を残しましょう．

災害後

- 電源の確保ができ，酸素ボンベも確保できれば，平時の酸素流量に戻して下さい．
- 災害前と同様に，散歩や体操などで，身体を動かす時間を作りましょう．

II. 研究成果の刊行に関する一覧

書籍

著者氏名	論文タイトル名	書籍全体の編集者名	書　籍　名	出版社名	出版地	出版年	ページ
該当なし							

雑誌

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Ⅳ. 研究成果の刊行物・別刷

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Original article

The burden of chronic obstructive pulmonary disease in the elderly population

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is a common disease and an important health care problem in older adults. The impact of age and specific geriatric issues on COPD in elderly patients has not been well established.

Methods: A cross-sectional study of elderly COPD patients was conducted in Japan by using a regional COPD registry database. We compared indices of disease severity (pulmonary function, exercise tolerance, quality of life, and frequency of exacerbations), presence of comorbidities, geriatric conditions (cognitive function, mental status, and activities of daily living [ADL]), and adherence to prescribed drug regimens between elderly and younger patients with COPD.

Results: In total, 279 patients with stable COPD (median age, 74 years) were identified; 86% of these patients were elderly (65 years of age or older). Elderly COPD patients, especially those who were 75 years of age or older, had significantly more cases of dyspnea, lower exercise tolerance, and poorer ADL and a higher incidence of severe exacerbations than younger patients (all $P<0.05$). In addition, the prevalence of comorbidities, including cardiovascular disease and cancer, was significantly higher in elderly COPD patients. Elderly COPD patients had specific geriatric conditions, including cognitive impairment. Adherence to inhaled drug regimens in elderly patients was as favorable as that in younger patients.

Conclusions: Age and specific geriatric conditions have a great negative impact on COPD in elderly patients. Geriatric conditions should be addressed in the management of elderly COPD patients.

Abbreviations: ADL, activities of daily living; COPD, chronic obstructive pulmonary disease; FEV_1, forced expiratory volume in 1 s; FVC, forced vital capacity; GOLD, The Global Initiative for Chronic Obstructive Lung Disease

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1. Introduction

Chronic obstructive pulmonary disease (COPD) is a major cause of mortality and morbidity worldwide and is characterized by high symptom burden and health care utilization [1]. The prevalence of COPD increases with age; it is 2–4 times more prevalent in those older than 65 years of age than in those 45–64 years of age [2–4]. Older age is associated with mortality resulting from COPD [5,6]. Therefore, COPD is considered a common disease and is an important health care problem in older adults.

The elderly population is projected to grow significantly [7]; hence, the number of elderly COPD patients is expected to increase. However, little is known about the impact of age on COPD. Moreover, specific geriatric issues in elderly COPD patients have not been well addressed, such as the presence of multiple comorbidities, cognitive impairment, frailty, and adherence to medication regimens.

In this study, we assessed data from a regional COPD registry database in Japan, which has one of the most rapidly aging societies in the world, to determine if elderly COPD patients have a greater burden of disease than younger patients. We also evaluated geriatric conditions in elderly COPD patients.

2. Materials and methods

2.1. Study design

This study was part of an ongoing prospective study of COPD patients who were registered with the Ishinomaki COPD Network (ICON). ICON was established in 2009 as a regional medical liaison system to provide comprehensive care of COPD patients in Ishinomaki, Japan, via an interdisciplinary collaboration with pulmonary physicians and nurses at a tertiary hospital, general practitioners and nurses at primary care clinics, pharmacists at health insurance pharmacies, physiotherapists at rehabilitation clinics, and nurses at home visit nursing stations. Currently, ICON includes 11 hospitals and 49 primary care clinics, collaborating with home visit nursing stations and the Japan Pharmaceutical Association in Ishinomaki. Registered patients with COPD who have provided written informed consent undergo an integrated intervention, including a comprehensive assessment, treatment, rehabilitation, and education at the Japanese Red Cross Ishinomaki Hospital (a 452-bed tertiary community hospital in Ishinomaki). These patients are regularly treated at the clinics of primary care physicians in Ishinomaki and surrounding cities, and undergo scheduled examinations and receive education at the Japanese Red Cross Ishinomaki Hospital.

We conducted a cross-sectional study of elderly COPD patients registered with ICON between January and December 2012. The protocol for this study was approved by the Ethics Committee of the Japanese Red Cross Ishinomaki Hospital (approved on February 14, 2014; number 13–37), and all patients provided written informed consent.

2.2. Patients

All participants were enrolled from the ICON registry and were diagnosed with COPD in accordance with the Global Initiative for Chronic Obstructive Lung Disease (GOLD) [1]. Airflow limitation was defined as post-bronchodilator forced expiratory volume in 1 s (FEV_1)/forced vital capacity (FVC) <0.7. These patients received optimal medical therapy in accordance with guidelines [1,8] and underwent scheduled examinations in 2012.

2.3. Data collection

Sociodemographic characteristics, smoking status, and maintenance treatments were recorded for each patient. Body mass index was calculated in kilograms per square meter. Dyspnea was evaluated using the modified Medical Research Council (mMRC) score [9].

Pulmonary function tests were conducted by a well-trained technician following guidelines under stable conditions [10], and the severity of airflow limitation was classified in accordance with the GOLD criteria [1]. The 6-minute walk test (6MWT) was performed by following the guidelines [11] with some modifications, including oxygen saturation monitoring and interruption of walking if the oxygen saturation decreased to <85%. The activities of daily living (ADL) status was evaluated by using the Nagasaki University Respiratory Activities of Daily Living Questionnaire; total scores range from 0 to 100, with lower scores indicating greater functional impairment [12]. Cognitive function and mental status were assessed using the Mini-Mental State Examination (MMSE) [13] and the Hospital Anxiety and Depression Scale [14], respectively. The MMSE score ranges from 0 to 30, and a score of ≤ 23 indicates cognitive impairment. Both the anxiety subscale and depression subscale scores of the Hospital Anxiety and Depression Scale range from 0 to 21, and a score of ≥ 8 indicates clinically relevant symptoms. COPD-related health status was evaluated using the COPD Assessment Test (CAT) [15,16]. The CAT score ranges from 0 to 40, with higher scores indicating worse quality of life [15].

The frequency of exacerbations that required hospitalization in the previous year was assessed using direct patient interviews, diaries kept by patients or caregivers, and the evaluation of medical records.

The presence of comorbidities was also assessed, including cardiovascular diseases (ischemic heart disease, heart failure, and atrial fibrillation), cerebrovascular disease, gastric ulcer and gastroesophageal reflux disease, chronic hepatic disease, diabetes, and cancer.

Adherence to inhaled drug regimens was evaluated using direct patient interviews, diaries kept by patients or caregivers, and reviews of prescriptions. We defined "good adherence" as complete adherence to prescription of inhaled drugs. If a patient failed to inhale drugs as prescribed, it was defined as "poor adherence." Pharmacists or trained nurses educated patients to inhale drugs properly according to standard instructions that included preparation, timing and speed of inhalation, cleaning of device, or gurgle after inhalation. When a patient performed all procedures correctly, it was regarded as a "good maneuver."

2.4. Statistical analyses

Comparisons between 2 groups were analyzed using the Student *t* test or Mann–Whitney *U* test. Multiple comparisons between groups were analyzed using the Tukey–Kramer test or Steel–Dwass test. Frequency analysis was performed with the chi-square for independence test. *P* values less than 0.05 were considered significant.

3. Results

3.1. Characteristics and geriatric conditions in elderly COPD patients

In total, 279 patients with stable COPD (48–92 years of age) were identified. The median age of these patients was 74 (interquartile range, 6.4) years, and 86% were 65 years of age or older. The characteristics of the patients are shown in Table 1.

Table 1 – Characteristics of 279 patients with stable chronic obstructive pulmonary disease.

Age, year	
45–64	39 (14.0%)
65–74	101 (36.2%)
75–84	115 (41.2%)
85 and older	24 (8.6%)
Male sex	257 (92.1%)
Body mass index, kg/m^2	23.1 (5.0)
Smoking history, pack-years	52.0 (38.9)
Dyspnea, mMRC	2 (1)
Pulmonary function tests	
FEV_1, L	1.47 (0.89)
$\%FEV_1$, %	63.1 (34.2)
FVC, L	3.04 (1.20)
GOLD stage, I/II/III/IV	62/132/62/23
Comorbidities	
Cardiovascular disease	47 (16.8%)
Cerebrovascular disease	13 (4.7%)
Ulcer, GERD	35 (12.5%)
Chronic hepatic disease	10 (3.6%)
Diabetes	38 (13.6%)
Cancer	42 (15.1%)
Regular medications	
LAMA	243 (87.1%)
LABA	62 (22.2%)
ICS/LABA	114 (40.9%)
ICS	12 (4.3%)
Theophylline	14 (5.0%)
Oral corticosteroids	0 (0%)
Long-term oxygen therapy	32 (11.5%)

Each data point is number (%), median (interquartile range), or number. GOLD stage I:$\%FEV_1 \geq 80\%$; II: $50\% \leq \%FEV_1 < 80\%$; III: $30\% \leq \%FEV_1 < 50\%$; and IV:$\%FEV_1 < 30\%$.
FEV_1: forced expiratory volume in 1 s, $\%FEV_1$: percentage of predicted FEV_1, FVC: forced vital capacity; GERD: gastroesophageal reflux disease; LAMA: long-acting anticholinergics, LABA: long-acting beta-agonists, and ICS: inhaled corticosteroids.

The patients were classified in terms of age (younger than 65 years, 65–74 years, 75–84 years, and 85 years and older), and comparisons of the characteristics of the 4 groups are shown in Table 2. The percent predicted FEV_1 values were not significantly different among the groups. The actual value of FEV_1 was significantly lower in elderly COPD patients than in patients younger than 65 years of age (compared with the group that was 65–74 years of age, $P<0.05$; compared with the groups that were 75–84 years of age and 85 years of age or older, each $P<0.01$). Elderly patients had significantly more dyspnea (75–84 years of age and 85 years of age or older, each $P<0.05$) and lower exercise tolerance (65–74 years of age, $P<0.05$; 75–84 years of age and 85 years of age or older, each $P<0.01$) than patients who were younger than 65 years of age. The ADL of elderly COPD patients were significantly poorer than those of younger patients (75–84 years of age and 85 years of age or older, each $P<0.05$). Elderly COPD patients had a higher incidence of severe exacerbations that required hospitalization ($P<0.05$). Mental status (anxiety and depression) was not significantly different among the groups.

The elderly COPD patients had multiple comorbidities (Table 3). Cardiovascular disease was the most frequent comorbidity in elderly COPD patients (18.8%). Elderly COPD patients had significantly higher rates of comorbidities, including cardiovascular disease and cancer (each $P<0.05$), than younger patients.

3.2. Elderly COPD patients who were 64–75 years of age compared with those who were older than 75 years of age

We then compared the indices of disease severity and geriatric conditions between younger elderly patients with COPD (65–74 years of age) and older elderly patients with COPD (75 years of age or older), as shown in Table 2. The percent predicted FEV_1 values were not significantly different between the 2 groups. The older elderly patients had significantly more dyspnea, lower exercise tolerance, and poorer ADL status than the younger elderly patients ($P<0.001$ for all comparisons). The older elderly patients also experienced a greater negative impact on quality of life than the younger elderly patients ($P<0.01$). In addition, the older elderly patients had a higher incidence of severe exacerbations that required hospitalization ($P<0.05$) and significantly greater cognitive decline ($P<0.001$). The prevalence of comorbidities was also significantly higher in the older elderly patients ($P<0.05$) (Table 3).

3.3. Adherence to inhaled drug regimens in elderly COPD patients

The maintenance treatments for these patients are shown in Table 4. All patients were provided with appropriate care, and the differences between treatment regimens were not significant. Adherence to inhaled drug regimens was favorable for both elderly and younger patients, and the difference in adherence was not significant ($P=0.57$) (Table 5). Patients with good adherence showed good maneuvers.

Table 2 – Characteristics of 279 patients with chronic obstructive pulmonary disease categorized according to age.

	<65 years (n=39)	65–74 years (n=101)	75–84 years (n=115)	>85 years (n=24)
GOLD stage, I/II/III/IV	10/19/7/3	21/53/19/8	24/55/25/11	7/5/11/1
Body mass index, kg/m^2	23.0 (3.8)	23.5 (5.2)	23.8 (4.9)	20.4 (3.4)[a]
Smoking status, current/ex/never	4/35/0	5/94/2	6/107/2	1/22/1
Smoking history, pack-years	40 (25)	56 (37)	52 (43)	52 (23)
FEV_1, L	2.03 (1.24)	1.61 (0.83)[a]	1.34 (0.65)[b,c]	0.95 (0.81)[b,c]
$\%FEV_1$, %	67.1 (33.6)	66.3 (30.8)	58.8 (29.5)	48.2 (43.7)
Dyspnea, mMRC	1 (1)	1 (1)	1 (2)[a]	2 (2)[a]
6MWT distance, m[e]	431 (96)	392 (141)[a]	318 (197)[b,c]	251 (188)[b,c]
ADL	100 (2.5)	98 (7)	94 (23)[a]	84.5 (38.8)[a]
MMSE	ND	27 (3)	26 (5)[c]	22.5 (6)[c,d]
Anxiety	3 (4.5)	2 (4)	2 (5)	2 (4.3)
Depression	4 (6)	2 (3)	4 (6)	4 (4.3)
CAT[f]	6 (9)	5 (8)	8 (8)	9 (8.5)
Severe exacerbations in the previous year	2 (5.1%)	5 (5.0%)	12 (10.4%)	6 (25%)[a]

Each data point is number, number (%), or median (interquartile range). GOLD stage I:$\%FEV_1 \geq 80\%$; II: $50\% \leq \%FEV_1 < 80\%$; III: $30\% \leq \%FEV_1 < 50\%$; and IV:$\%FEV_1 < 30\%$. The difference between the group younger than 65 years of age and the other groups (65–74 years, 75–84 years, and ≥ 85 years) was considered significant with $P<0.05$.

FEV_1: forced expiratory volume in 1 s, $\%FEV_1$: percentage of predicted FEV_1, 6MWT: 6-minute walk test, ADL: activities of daily living; MMSE: Mini-Mental State Examination; CAT: COPD Assessment Test; and ND: not done.

[a] $P<0.05$.

[b] $P<0.01$; the difference between the group aged 65–74 years and the other groups (75–84 years and ≥ 85 years) was considered significant with $P<0.05$.

[c] $P<0.01$; the difference between the group aged 75–84 years and the group aged ≥ 85 years was considered significant with $P<0.05$.

[d] $P<0.01$.

[e] The 6MWT was not performed in 4 patients because of orthopedic disease or frailty.

[f] The CAT score was not available in 6 patients.

Table 3 – Comorbidities of 279 patients with chronic obstructive pulmonary disease categorized according to age.

	<65 years (n=39)	65–74 years (n=101)	75–84 years (n=115)	>85 years (n=24)
Presence of any comorbidities	10 (25.6%)	44 (43.4%)[a]	64(55.7%)[b]	16 (66.7%)[b,c]
Comorbidities				
Cardiovascular disease	2	13	24[a]	8[b]
Cerebrovascular disease	1	4	7	1
Ulcer, GERD	7	13	12	3
Chronic hepatic disease	0	5	5	0
Diabetes	2	12	21[a]	3
Cancer	1	14[a]	22[b]	5[a]

Each data point is a number.

The difference between the group younger than 65 years and the other groups (65–74 years, 75–84 years, and ≥ 85 years) was considered significant with $P<0.05$.

GERD: gastroesophageal reflux disease.

[a] $P<0.05$.

[b] $P<0.01$; the difference between the group aged 65–74 years and the other groups (75–84 years and ≥ 85 years) was considered significant with $P<0.05$.

[c] $P<0.05$.

4. Discussion

The present study showed that elderly COPD patients have a greater burden of disease, including more dyspnea and lower exercise tolerance, especially those who are 75 years of age or older. In addition, the results of our study indicated that geriatric patients with COPD have poorer ADL status and a higher incidence of severe exacerbations that require hospitalization. Elderly patients have specific physiological changes, including reduced body weight, lean body mass, and decreased respiratory muscle strength [17,18]. Age-associated changes in the structure and function of the lung may increase the burden of disease severity in geriatric patients with COPD, which leads to poorer ADL status. Recent studies have shown that physical inactivity is associated with exacerbations and hospital admissions [19–21]. Poor ADL status may be responsible for the higher incidence of severe exacerbations that require hospitalization in elderly COPD patients despite adequate treatment.

The present study also showed that specific geriatric conditions have a negative impact on elderly COPD patients. The results of our study indicate that elderly COPD patients

Table 4 – Regular medications of 279 patients with chronic obstructive pulmonary disease categorized according to age.

	<65 years (*n*=39)	65–74 years (*n*=101)	75–84 years (*n*=115)	>85 years (*n*=24)
LAMA	37	96	104	19
LABA	6	21	29	6
ICS/LABA	17	41	47	9
ICS	1	5	5	1
Theophylline	1	4	7	1
Long-term oxygen therapy	2	7	19	4

Each data point is a number.
LAMA: long-acting anticholinergics, LABA: long-acting beta-agonists, and ICS: inhaled corticosteroids.

Table 5 – Adherence to inhaled drug regimens of patients with chronic obstructive pulmonary disease categorized according to age.

	<65 years (*n*=39)	65–74 years (*n*=101)	75–84 years (*n*=115)	>85 years (*n*=24)
Prescribed inhaled drugs	39	96	109	19
Good adherence	34 (87.2%)	79 (82.3%)	91 (89.0%)	16 (84.2%)

Each data point is a number or number (%). Good adherence was defined as complete adherence to prescription of inhaled drugs.

have multiple comorbidities. Previous studies have shown that COPD often coexists with comorbid conditions related to the duration of smoke exposure or systemic inflammation [22,23]. In this study, the prevalence of comorbidities was not associated with smoking history, which may indicate that multiple comorbidities in COPD are related to aging and systemic inflammation.

Poor mental status and cognitive impairment may have a negative impact on older COPD patients. Although previous research showed an increased prevalence of poor health status in older COPD patients [24,25], the prevalence of depression and anxiety was not significant in both younger and elderly patients with COPD in this study. The discrepancy may be explained by the fact that all patients enrolled in this study received comprehensive treatment by their primary care physicians. An association between COPD and cognitive impairment has been reported, but these results are controversial [26,27]. We observed significant cognitive impairment in elderly COPD patients. Both aging and COPD-associated risk factors, such as hypoxemia or cerebrovascular disease, may contribute to cognitive impairment in COPD patients.

Adherence to prescribed drug regimens is considered challenging for the elderly population because of inadequate health care literacy and the presence of geriatric conditions [28]. Previous studies showed that only 50% of inhalant users with COPD take their medications as prescribed [29,30]. In this study, geriatric patients with COPD had favorable adherence to inhaled drug regimens as compared with younger patients. All participants in this study underwent a comprehensive assessment, including cognitive function, and instruction on techniques for using inhaled drugs at their scheduled visit at the referral hospital; thus, respiratory specialists made appropriate decisions with respect to medication regimens. These findings propose that chest physicians should evaluate the presence of geriatric conditions and then select an appropriate inhalation device and provide instructions on inhalation maneuvers to elderly COPD patients.

Our findings are presumed to reflect the impact of age on community-dwelling patients with COPD in an aging society. This study was conducted with a regional COPD registry database in Japan, which is one of the most rapidly aging societies in the world. In 2010, 23% of Japanese people were 65 years of age or older, and 26.6% of people living in Ishinomaki 65 years of age or older [31]. In this study, all participants were treated regularly at the offices of primary care physicians. The findings of our study are applicable to the management of elderly COPD patients in aging societies worldwide.

A potential weakness of this study is the inclusion of patients who are manageable in a primary care setting. Patients with very severe COPD who are treated by respiratory specialists were excluded from this study. In addition, frail elderly patients who could not visit a tertiary hospital were excluded from this study. Further studies are needed to clarify the characteristics of these patients.

5. Conclusion

In conclusion, age and specific geriatric conditions have a great negative impact on elderly COPD patients. We propose the development of strategies for the management of elderly COPD patients.

Conflict of interest

The authors have no conflicts of interest.

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Case report

Scedosporium aurantiacum brain abscess after near-drowning in a survivor of a tsunami in Japan

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ABSTRACT

Many victims of the tsunami that occurred following the Great East Japan Earthquake on March 11, 2011 developed systemic disorders owing to aspiration pneumonia. Herein, we report a case of tsunami lung wherein *Scedosporium aurantiacum* was detected in the respiratory tract. A magnetic resonance image of the patient's head confirmed multiple brain abscesses and lateral right ventricle enlargement. In this case report, we describe a potential refractory multidrug-resistant infection following a tsunami disaster.

Abbreviations: CNS, central nervous system; CT, computed tomography; BAL, bronchoalveolar lavage; MRI, magnetic resonance imaging; CSF, cerebrospinal fluid; M, male; F, female; PCR, polymerase chain reaction; VRCZ, voriconazole; MCFG, micafungin; L-AMB, liposomal amphotericin B; FLC, fluconazole; PMX-DHP, polymyxin B-immobilized fiber column direct hemoperfusion

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1. Introduction

Several survivors of the tsunami in northeastern Japan developed lung and brain abscesses caused by *Scedosporium* spp. [1,2]. Central nervous system (CNS) infections secondary to *Scedosporium* spp. can occur in near-drowning individuals whereupon large inoculums of the fungi are aspirated into the respiratory tract and reach the CNS through hematogenous spreading. In this report, we describe a case of a female patient who acquired lung and CNS *Scedosporium* infection following a near-drowning aspiration event during a tsunami. We focus on the difficulties in establishing the correct diagnosis and choosing the best therapeutic approach.

2. Case

A 68-year-old Japanese woman who had been washed away by a tsunami was rescued and sent to a coastal clinic. She was gasping and short of breath after coughing paroxysms, and was transferred to a neighboring hospital owing to low oxygen saturation (67% on 10 L/min of supplemental oxygen) as determined by pulse oximetry. At the hospital, she stated that she underwent insulin therapy for diabetes, and a physical examination upon admission revealed a body temperature of 33.5 °C, blood pressure of 92/46 mmHg, and a regular pulse of 75 beats per minute. There was no evidence of trauma or fractures anywhere on her body. Lung auscultation revealed coarse crackles in both lungs. Her heart sounds were normal. She was confused, but a neurologic examination yielded negative findings. The laboratory findings were as follows: white blood cell count, 4200 cells/μL (reference range, 4000–9000 cells/μL); hemoglobin, 12.9 g/dL (reference range, 12.0–15.0 g/dL); platelets, 85,000 cells/μL (reference range, 13.0–34.0 cells/μL); aspartate aminotransferase, 2140 IU/L (reference range, 8–40 IU/L); alanine aminotransferase, 748 IU/L (reference range, 5–35 IU/L); lactate dehydrogenase, 1160 IU/L (reference range, 121–226 IU/L); and a negative C-reactive protein test. Arterial gas analysis showed severe hypoxemia (pH, 7.25; $PaCO_2$, 45; and PaO_2, 41 Torr) even though 10 L/min of supplemental oxygen was being administered. A chest radiograph revealed diffuse infiltration in both lung fields. On the basis of these findings, the patient was diagnosed with aspiration pneumonia due to near-drowning. The patient was treated with 0.5 g of meropenem intravenously twice a day and steroid pulse therapy. Eight hours after admission, her body temperature was 38.2 °C and her oxygen saturation, measured by pulse oximetry, was 92% on 4 L/min of supplemental oxygen. On hospital day 7, she had a body temperature of 37.4 °C, a good appetite, and was stable without supplemental oxygen. The aspartate aminotransferase, alanine aminotransferase, and lactate dehydrogenase levels also normalized; however, the C-reactive protein level had risen to 10.2 mg/dL (reference range, 0–0.40). A chest radiograph showed decreased infiltrates on both sides. On hospital day 16, the patient was found to still have a body temperature of 37.5 °C; therefore, the treatment was switched from meropenem to 2 g of piperacillin intravenously twice a day. On hospital day 26, chest computed tomographic (CT) scans showed pleural effusion and multiple nodular lesions in both sides (Fig. 1a), and the level of (1→3)-β-D-glucan had increased to 123.4 pg/mL (reference range, 0–20 pg/mL). Fungal lung disease was suspected, and treatment with 150 mg of micafungin intravenously once a day was initiated; however, the patient then presented with a body temperature of 38.5 °C. As a result, she was transferred to our hospital 42 days after her initial visit to the previous hospital. Upon admission to our hospital, she presented with generalized fatigue and had a fever of 39 °C, blood pressure of 142/92 mmHg, and tachycardia at a rate of 112 beats per minute. Auscultation of the chest revealed some crackles in both lungs. Her heart sounds were normal, and an abdominal examination also yielded normal results. Tsunami-associated refractory pneumonia was suspected on the basis of clinical appearance. Upon admission to our hospital, normal flora was isolated from the sputum. The level of (1→3)-β-D-glucan was 35.5 pg/mL. *Pneumocystis carinii* infection was suspected, and trimethoprim-sulfamethoxazole (trimethoprim 4.8 mg/kg 3 times per day) was started. On day 2 at our hospital, a CT scan of the head demonstrated normal findings, and a scan of the chest revealed bilateral smooth septal thickening, bilateral pleural effusions, and compressive atelectasis (Fig. 1b). Subsequently, Gram staining of bronchoalveolar lavage (BAL) fluid demonstrated filamentous fungi under microscopic examination collected BAL fluid from the left lower bronchus (B9); therefore, treatment with 150 mg of micafungin intravenously once a day was continued. On day 16 at our hospital, the patient became hypotensive and developed right-sided flaccid paralysis. She was therefore diagnosed as having a cerebral infarction and was treated with 30 mg of argatroban and edaravone intravenously twice a day. Owing to the increase in (1→3)-β-D-glucan levels to 47.8 pg/mL, micafungin-refractory fungal infection was suspected, and the antimycotic therapy was switched to voriconazole at 400 mg twice a day. On day 29 at our hospital, she lost consciousness and developed flaccid paralysis of the left arm and leg (double hemiplesia). A neurological examination disclosed exaggerated tendon reflexes, and brain magnetic resonance imaging (MRI) showed intraventricular abscesses (Fig. 1c). Blood and cerebrospinal fluid (CSF) cultures for bacteria were negative, and the level of (1→3)-β-D-glucan in the CSF was increased to 243 pg/mL on day 45 at our hospital. After informed consent was obtained from the patient, voriconazole was given in doses of 14 mg consecutively for 10 days intrathecally and the level of (1→3)-β-D-glucan was found to be reduced to 18.9 pg/mL of CSF on day 54 at our hospital. A diagnosis of *Scedosporium aurantiacum* infection was confirmed on day 62 at our hospital by performing polymerase chain reaction and deoxyribonucleic acid (DNA) sequencing of the filamentous fungi obtained from the BAL specimens taken on day 2 at our hospital and cultured on Sabouraud dextrose agar. Although the *S. aurantiacum* isolates were susceptible to voriconazole, an MRI of the head taken on day 131 at our hospital confirmed multiple brain abscesses and lateral right ventricle enlargement. Because enhanced antifungal activity has been demonstrated *in vitro* against combinations of amphotericin B plus azoles [3], we decided to include amphotericin B (125 mg of liposomal amphotericin B once a day) to the antifungal regimen on day 170 at our hospital.

A follow-up cranial MRI revealed a decrease in the size of the enhancing lesions in the right occipital lobe 28 days after the combination therapies were initiated. The chest radiograph on day 215 at our hospital also demonstrated a remarkable improvement of the bilateral effusion, and supplemental oxygen therapy was discontinued.

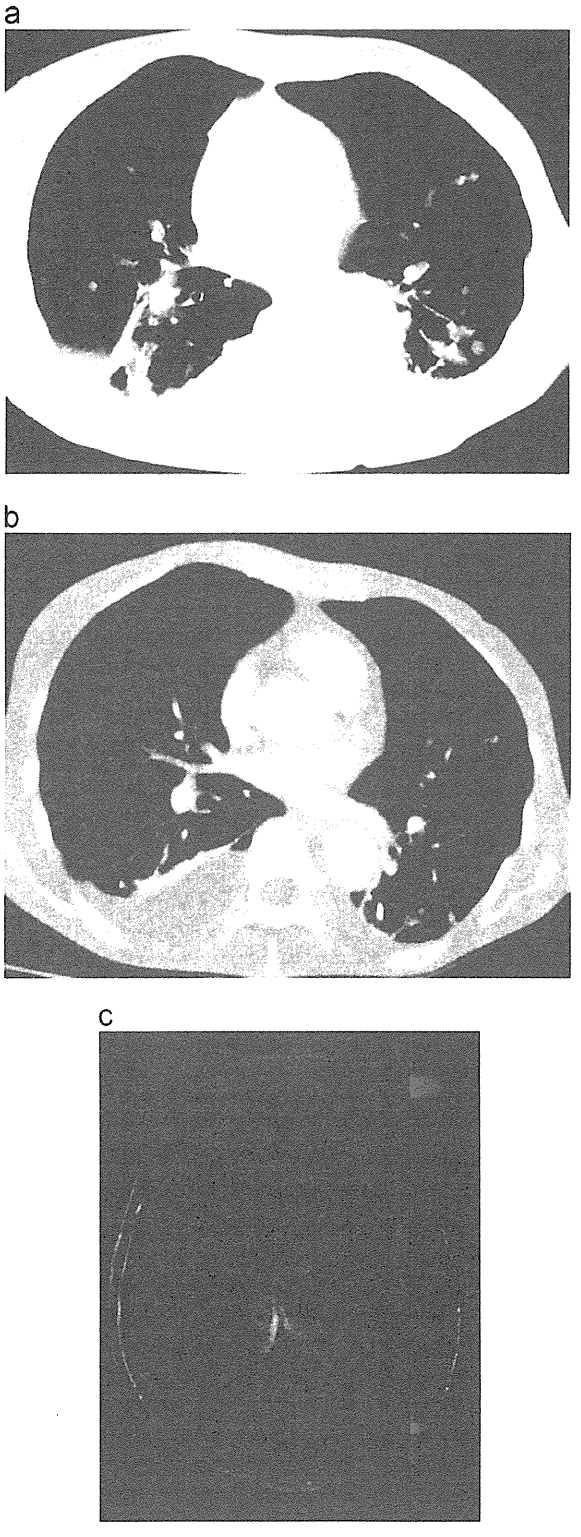

Fig. 1 – Chest computed tomography (CT) and magnetic resonance imaging (MRI) of patients with *Scedosporium* infection. (a) Taken on hospital day 16, this CT scan shows bilateral smooth septal thickening, pleural effusions, multiple nodular lesions, and compressive atelectasis. (b) Taken on day 2 at our hospital, this CT image shows extensive bilateral diffuse infiltrates, consolidations, and ground-glass opacities. (c) Taken on day 29 at our hospital, this MRI (axial proton-density weighted image) shows increased bilateral subdural effusion and high signal intraventricular lesions that represent abscesses.

3. Discussion

Scedosporium spp. are ubiquitous, saprophytic, filamentous fungi that are being increasingly recognized as pathogens under specific conditions, including near-drowning. Entering through the most common route of entry, the respiratory tract, and left uncontrolled by a suppressed immune response, *Scedosporium* conidia may germinate, and hyphae may invade, typically producing a necrotizing pneumonia. Numerous publications have addressed the clinical manifestations of pulmonary *S. apiospermum* and *S. prolificans*, [4] in which chest radiographic findings have varied from focal unilateral to bilateral diffused infiltrates and from nodules to bronchopneumonia. As the disease progresses, cavitation has also been noted [4]. As it is difficult to distinguish scedosporiosis from other forms of pneumonia by clinical and radiographic image analysis, and because the fungi are often multidrug-resistant, specific laboratory diagnostics have been highly recommended. Commercial colorimetric assays have been developed to detect (1→3)-β-D-glucan, a major cell wall component of several medically important fungi. A prospective diagnostic study reported increased levels of (1→3)-β-D-glucan in 3 patients with *S. apiospermum* infections [5]. The decreasing levels of (1→3)-β-D-glucan in the serum and CSF samples obtained throughout our case were accompanied by symptomatic and radiological improvements. These observations demonstrate the value of surrogate markers for monitoring the course of invasive scedosporiosis during therapy.

Microscopically, *Scedosporium* spp. resemble *Aspergillus* and *Cunninghamella*, fungi that are also found in soil and stagnant or polluted water. However, *Scedosporium* spp. mold colonies grown on standard mycologic media take on colors that are quite different from *Aspergillus* and *Cunninghamella*. In our case, *Aspergillus* and *Cunninghamella* were not detected by culturing or the direct sequencing of DNA. Previously, fungi isolated after a near-drowning aspiration event following a tsunami in 2004 and originally identified as *S. apiospermum* [6] were later re-identified as *Pseudallescheria boydii* and *S. aurantiacum* using DNA sequencing [7]. Thus, reliable identification could be achieved only by molecular methods.

Deeply invasive and disseminated infections caused by *Scedosporium* spp. are most commonly caused by penetrating trauma or the aspiration of polluted water, and they may