

VI. 診断・検査

測定・検査・指標に関する最近の研究

耐糖能障害症例における動脈硬化危険因子集積の 軽減のための内臓脂肪面積目標値

The cutoff point of visceral fat area as a goal for improving risk factors of arteriosclerosis in the patients with glucose intolerance

長野真弓¹ 佐々木 悠² 熊谷秋三³

Key words : 内臓脂肪, 代謝性症候群, 全身持久力, 心理的ストレス

はじめに

WHO(世界保健機関)¹⁾およびアメリカのNational Cholesterol Education Programにおける第三次成人管理基準²⁾では, 腹部型肥満, 耐糖能異常, 脂質代謝障害, 高血圧が同一個体に集積した状態を代謝性症候群 (metabolic syndrome: MS)と定義し, 動脈硬化症の強力な予測因子として位置付けた。また我が国では, 大阪大学の研究グループが, 正常耐糖能および耐糖能異常者において, 耐糖能異常者の内臓脂肪面積 (visceral fat area: VFA)が正常耐糖能者のそれよりも有意に高く, 両群ともに, 内臓脂肪蓄積が高い者ほど動脈硬化危険因子の集積数が多いことを報告している³⁾。そのほか, 多くの疫学研究によって内臓脂肪蓄積が心疾患発症の予測因子であることも報告されており⁴⁾, 今や内臓脂肪蓄積は, 動脈硬化発症にかかわる代謝性疾患やその合併を反映する重要なマーカーとして認識されている。

九州大学健康科学センターでは, 1994年から現在まで, 比較的病歴の短い耐糖能異常者を対象に, 運動や食事などの行動要因の変容を促す病院外施設における非薬物療法プログラムを实

施しているが, 当施設での耐糖能異常者のベースライン調査時点で, 全対象者の85%が日本肥満学会による腹部型肥満に該当し, そのうち55%がWHO基準によるMSと判定された。これは, 我が国における地域住民のMS罹患率(24%)の倍以上に相当する頻度であった。

そこで本稿では, 当施設における健康行動支援プログラムの基礎概念となっている疾病生成プロセスでの内臓脂肪蓄積の位置付けや, 内臓脂肪蓄積に関与する要因を解説し, 動脈硬化危険因子合併の予防・改善のためのVFA目標値について当施設で得られたデータを提示し, 病態改善の目標値設定の意義に関して考察したい。

1. 内臓脂肪蓄積のメカニズム

—疾病生成プロセスの観点から—

Björntorp⁵⁾は, 多くの疫学・臨床研究成績を基に, 動脈硬化発症のマーカーであるMS発現プロセスについての仮説を提唱した。その仮説は, ストレス対処が個人の心理的特性によってうまくいかず, ストレスを介した神経内分泌系の障害(視床下部-下垂体-副腎軸の攪乱および性腺系の抑制)がコルチゾール分泌促進, 性ホルモン低下を招き, 内臓脂肪蓄積やインスリ

¹Mayumi Nagano: Graduate School of Human-Environment Studies, Kyushu University 九州大学大学院人間環境学府 ²Haruka Sasaki: Second Division of Internal Medicine, Chikushi Hospital, Fukuoka University 福岡大学筑紫病院内科2 ³Shuzo Kumagai: Institute of Health Science, Kyushu University 九州大学健康科学センター

ン抵抗性をもたらして糖・脂質代謝障害を発現させる,あるいはストレスによる交感神経系の亢進が高血圧を誘発してMS,ひいては動脈硬化症を発症するというものである.このように,疾病生成プロセスにおける内臓脂肪蓄積は,インスリン抵抗性あるいはその代償機構としての高インスリン血症に並び種々の代謝性疾患発症の基盤を形成している要因と考えられている.

2. 内臓脂肪蓄積の増減に関与する要因について—非薬物療法の観点から—

耐糖能異常者では,正常耐糖能者に比べて心理的ストレス(うつや不安など)が多く,耐糖能異常者の中でも心理的ストレスの高い群では内臓脂肪が有意に高値⁸⁾であること,うつを有する耐糖能異常者の血糖コントロールがうつを伴わない患者よりも有意に悪化していること⁷⁾が報告されており,心理的特性の悪化と内臓脂肪蓄積,および耐糖能異常の発現の間には何らかの関連性が存在するようである.しかしながら,心理的ストレスと内臓脂肪蓄積の因果関係を決定付ける前向きコホート研究や介入研究は,著者らの知るかぎり見当たらず,今後の報告が待たれる.

一方,食事・運動療法によって肥満,糖・脂質代謝異常などの動脈硬化危険因子が改善することは周知の事実である⁹⁾.特に食事療法に運動療法を併用した介入プログラムでは選択的に内臓脂肪が減少する可能性が示唆されている⁹⁾.また,当施設で実施されている耐糖能異常者の1年間の行動変容プログラムでも,同様の成績が観察されている¹⁰⁾.更に,最近発表されたインスリン抵抗性改善薬であるピオグリタゾン投与と,食事と運動による20週間の介入プログラムの効果比較では,薬物群で糖代謝指標の改善しか認められず,内臓脂肪にも変化がないばかりか体脂肪率まで増加したのに対し,運動と食事群においては,全身持久力の向上に伴い内臓脂肪をはじめとする全身の肥満指標,糖・脂質代謝指標も有意に改善し,非薬物療法の効果が改めて示された¹¹⁾.

ただし,このようなプログラム実施に際して

の留意点もある. Jayoら¹²⁾によれば,あらかじめ肥満状態にされたモンキーでは,運動継続に加え心理的ストレスを同時に与えると,ストレスのない運動群や,非運動群に比べ,ストレス下で運動した群の内臓脂肪蓄積が有意に多く,その増加に伴い代謝性疾患や動脈硬化への進展が認められたという.耐糖能改善のために,患者の日常生活に運動を定着させることは重要な課題であるが,プログラムを受ける者の心理状態によっては運動も逆効果になる可能性があることも考慮する必要がある.

以上のことから,今後の耐糖能異常者の治療においては,各分野の専門家が提携して行動・心理的要因の改善に当たる必要があると考えられる.

3. 動脈硬化危険因子合併を軽減するための内臓脂肪面積目標値

耐糖能異常者の病態の悪化防止や改善には,動脈硬化危険因子と強く関連する内臓脂肪を減少させることが急務である.当然の目標として,日本肥満学会の内臓脂肪型肥満の診断基準であるVFA 100 cm²以下に減らすのが最も望ましいと考えられるが,もともと極度に内臓脂肪が蓄積した耐糖能異常者(当施設来訪者の平均値:約160 cm²)にとって,この数値は達成するのにいささか困難であることは否めない.そこで,特に動脈硬化症へ移行するリスクが高いとされる危険因子の合併を改善,つまり危険因子数を1個以下にするためのVFAの目標値の設定は臨床的に意義のある課題であると考え解析を試みた.ここでは,既に動脈硬化危険因子を合併している耐糖能異常者を対象に行われた当施設における1年間の介入の成績を用い,危険因子の合併改善を目的として介入指導や治療を行う際の,VFAおよびウエスト周囲径の目標値について検討した¹³⁾.

対象は,前述の介入プログラムを1年以上継続し,再評価を受けた54人であった(平均介入期間:13.4±3.4カ月).プログラムの詳細については本誌「軽症糖尿病患者に対する「健康行動支援プログラム」の意義とその評価:熊谷秋三

表1 危険因子合併を呈していたプログラム参加者における介入前後の身体的特徴および代謝指標の変化

	男性(37人)		女性(17人)		main effect		inter-action
	before	after	before	after	sex	time	
年齢(歳)	51.0±15.0	52.1±15.1	56.3±12.5	57.4±12.6		*	
body mass index(kg/m ²)	25.3±4.3	24.1±2.5	25.6±5.1	24.4±3.6		*	
体脂肪率(%)	22.3±8.6	20.1±6.9	33.0±8.7	30.6±6.8	*	*	
ウエスト周囲径(cm)	88.8±9.1	85.8±6.3	90.1±14.3	84.5±9.5		*	
ウエストヒップ比	0.95±0.04	0.94±0.04	0.95±0.06	0.91±0.09		*	
皮下脂肪面積(cm ²)	161.9±103.2	135.8±59.9	209.2±127.4	215.0±97.0	*		
内臓脂肪面積(cm ²)	176.1±67.1	142.1±48.6	162.4±69.2	132.7±53.6		*	
最大酸素摂取量(ml/kg/min)	33.5±5.3	36.6±4.8	29.2±7.1	29.7±3.8	*	*	
空腹時血糖値(mg/dl)	134.3±32.6	123.0±23.7	138.1±34.5	122.2±15.7		*	
空腹時インスリン(μ U/ml)	8.6±7.9	6.4±5.2	7.6±3.8	7.6±6.9		*	
HOMA-IR	3.0±3.5	1.9±1.5	2.5±1.0	2.1±1.5		*	
HbA1c(%)	6.4±1.5	5.8±0.8	6.5±1.2	6.1±0.9		*	
総コレステロール(mg/dl)	226.2±45.7	215.2±36.9	235.6±29.9	230.7±27.4			
HDLコレステロール(mg/dl)	42.5±10.0	50.0±14.0	51.0±11.7	57.1±13.3	*	*	
中性脂肪(mg/dl)	185.4±92.4	155.4±84.0	138.1±67.8	123.7±57.0		*	
収縮期血圧(mmHg)	130.2±16.2	129.4±19.2	139.2±20.2	137.7±23.0			
拡張期血圧(mmHg)	83.1±9.6	80.6±12.1	86.4±12.4	84.8±12.6			
動脈硬化危険因子数(個)	3.0±1.0	2.2±1.2	2.6±0.6	2.2±0.9		*	

平均値±標準偏差, *p<0.05

ほか著¹⁴⁾および他著¹⁵⁾を参照されたい。その結果, 1年間の介入により, 皮下脂肪面積以外の肥満度, 体力および糖・脂質代謝指標に有意な改善が認められた(表1)。更に, 動脈硬化危険因子数も減少し, 対象者のうち26%(14人)が動脈硬化危険因子1個以下へと移行した。また, 少数例かつ1年間と比較的短期間の検討ではあるが, receiver operating characteristics分析によって得られた動脈硬化危険因子を1個以下にするための最も妥当なVFAの目標値は120cm²であった(図1)。加えて, 男性例ではVFAとウエスト周囲径との間に有意な相関関係が認められたことから, 利便性を考慮し, VFA 120cm²に対応するウエスト周囲径は84.8cmであった。今後は, 本研究で得られた目標値を達成・維持することで, その後の動脈硬化性疾患のイベント発症が抑制されるかどうかを確認するための更なる長期追跡研究が必要と考えられる。

おわりに

本稿では, 非薬物療法の観点から, 内臓脂肪

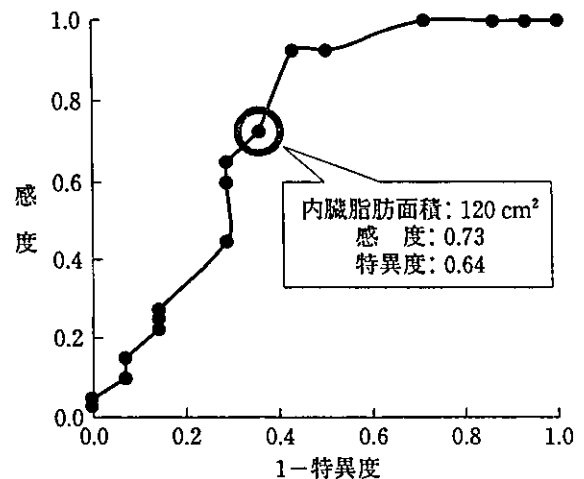


図1 動脈硬化危険因子を1個以下にするための内臓脂肪面積の目標値を示したROC曲線

蓄積のメカニズムや内臓脂肪蓄積に関連する諸要因について概説し, 更に当施設における介入データを基に動脈硬化危険因子の合併を防ぐための具体的なVFAの目標値を検討した結果を紹介した。なお, この目標値は少数例のデータから導き出されたものであることから, 今後も引

き続き例数を増やすとともに、動脈硬化症の発症抑制効果の確認も課題として残されている。

非薬物療法の治療効果の有効性は報告されているものの、実際には患者のケアにかかるコストや労力、それに携わる人材の育成、支援体制の構築など、課題も多い。しかし、増加の一途

をたどる耐糖能異常を減少させるためには、患者の意向によってはこのようなアプローチも治療の選択肢に入れる必要があると考えられ、患者が生活する場での血糖コントロールの改善を意識した健康行動支援プログラムおよび健康支援システムの充実が望まれる。

参考文献

- 1) WHO Consultation, Definition, diagnosis and classification of diabetes mellitus, and its complications. Part 1: Diagnosis and classification of diabetes mellitus, World Health Organization, Geneva, 1999.
- 2) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults: Executive summary of the third report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). *JAMA* 285: 2486-2497, 2001.
- 3) Nagaretani H, et al: Visceral fat is a major contributor for multiple risk factor clustering in Japanese men with impaired glucose tolerance. *Diabetes Care* 24: 2127-2133, 2001.
- 4) Fujimoto WY, et al: Visceral adiposity and incident coronary heart disease in Japanese-American men. The 10-year follow-up results of the Seattle Japanese-American Community Diabetes Study. *Diabetes Care* 22: 1808-1812, 1999.
- 5) Björntorp P: Neuroendocrine abnormality in human obesity. *Metabolism* 44: 38-41, 1995.
- 6) Viinamaki H, et al: Mental well-being in people with non-insulin-dependent diabetes. *Acta Psychiatr Scand* 92: 392-397, 1995.
- 7) Lustman PJ, et al: Depression and poor glycemic control: a meta-analytic review of the literature. *Diabetes Care* 23: 934-942, 2000.
- 8) Lehmann R, et al: Loss of abdominal fat and improvement of the cardiovascular risk profile by regular moderate exercise training in patients with NIDDM. *Diabetologia* 38: 1313-1319, 1995.
- 9) 甲斐裕子ほか: 医療機関と病院外施設の連携モデルと軽症糖尿病患者への健康行動支援プログラムの適用とその効果. *糖尿病* 46: 533-535, 2003.
- 10) Smith SR, Zachwieja JJ: Visceral adipose tissue: a critical review of intervention strategies. *Int J Obes* 23: 329-335, 1999.
- 11) Shadid S, Jensen MD: Effects of pioglitazone versus diet and exercise on metabolic health and fat distribution in upper body obesity. *Diabetes Care* 26: 3148-3152, 2003.
- 12) Jayo JM, et al: Effects of exercise and stress on body fat distribution in male cynomolgus monkeys. *Int J Obes Relat Metab Disord* 17: 597-604, 1993.
- 13) 甲斐裕子ほか: 耐糖能異常者の動脈硬化危険因子合併の改善を目的とした内臓脂肪面積の目標設定値に関する研究. *糖尿病* 46: 647-649, 2003.
- 14) 熊谷秋三, 佐々木 悠: 軽症糖尿病患者に対する「健康行動支援プログラム」の意義とその評価. *日本臨牀* 63(増刊号2): 649-653, 2005.
- 15) 熊谷秋三: 糖尿病患者への生活の場での健康支援. *現代のエスプリ* 440: 155-162, 2004.

Prevention of Late Complications by Half-Solid Enteral Nutrients in Percutaneous Endoscopic Gastrostomy Tube Feeding

Jiro Kanie^a Yusuke Suzuki^a Hiroyasu Akatsu^b Masafumi Kuzuya^a
Akihisa Iguchi^a

^aDepartment of Geriatrics, Medicine in Growth and Aging, Program in Health and Community Medicine, Nagoya University Graduate School of Medicine, Nagoya, and ^bDepartment of Internal Medicine, Fukushima Hospital, Toyohashi, Japan

Key Words

Percutaneous endoscopic gastrostomy · Enteral nutrients, half-solid · Gastroesophageal reflux

Abstract

Background: Percutaneous endoscopic gastrostomy feeding is accompanied by unique complications, which are not easily controlled. **Objective:** In an attempt to decrease complications, we used half-solid nutrients for percutaneous endoscopic gastrostomy feeding in an 85-year-old woman. The patient had been receiving enteral nutrients via percutaneous endoscopic gastrostomy, and we examined whether this approach can reduce complications. She presented with regurgitation of enteral nutrients and recurrent respiratory infections. **Methods:** Half-solid enteral nutrients, prepared by mixing liquid enteral nutrients with agar powder, were administered via percutaneous endoscopic gastrostomy. **Results:** Symptoms of gastroesophageal reflux disappeared immediately after the start of half-solid enteral nutrient feeding. **Conclusion:** Gastroesophageal reflux and leakage, two intractable late complications of percutaneous endoscopic gastrostomy tube feeding, can be alleviated

by the solidification of enteral nutrients. Since this method allows quick administration of nutrients, it is also expected to help prevent the occurrence of decubitus ulcers and reduce the burden to the caregiver.

Copyright © 2004 S. Karger AG, Basel

Introduction

Feeding via a percutaneous endoscopic gastrostomy (PEG) tube is a safe and efficient method for patients who cannot maintain adequate oral intake. PEG feeding is accompanied, however, by unique complications which are not easily controlled. The administration of liquid nutrients is often accompanied by complications such as vomiting and diarrhea, although these complications may be minimized if the patient is sitting up during the administration or if the nutrients are administered at a slower rate. Nevertheless, these methods do not completely succeed in eliminating these common complications, and may require the patients and their caregivers to have great patience. In addition, maintaining the same position for many hours may worsen the conditions of patients who have pressure ulcers. Here we report a case in which, by

KARGER

Fax +41 61 306 12 34
E-Mail karger@karger.ch
www.karger.com

© 2004 S. Karger AG, Basel
0304-324X/04/0506-0417\$21.00/0

Accessible online at:
www.karger.com/gcr

Jiro Kanie

Department of Geriatrics, Medicine in Growth and Aging, Program in Health and Community Medicine, Nagoya University Graduate School of Medicine
65 Tsurumai-cho, Showa-ku, 466-8550 Nagoya, Aichi (Japan)
Tel. +81 52 744 2364, Fax +81 52 744 2371, E-Mail yus@mod.nagoya-u.ac.jp

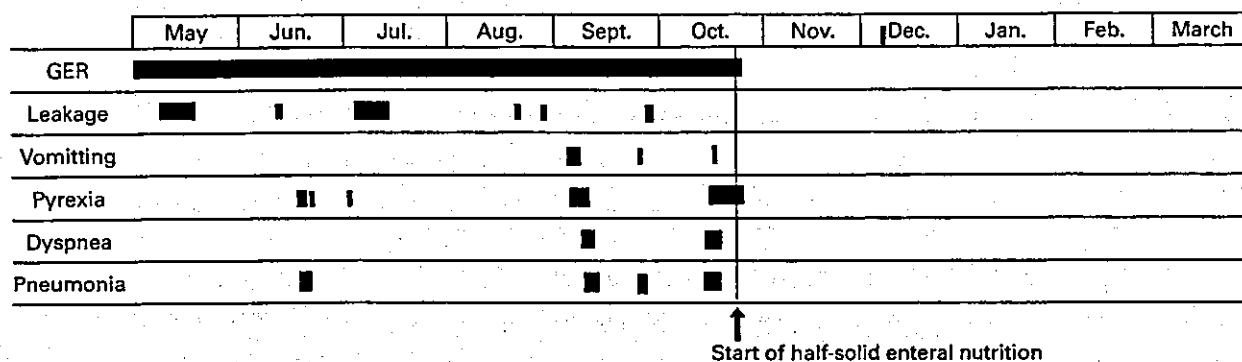


Fig. 1. Reduction of symptoms after half-solid enteral nutrition via PEG.

simply solidifying nutrients, the symptoms due to gastroesophageal reflux (GER) after PEG tube placement were relieved, and the leakage of nutrients from the PEG tube insertion site was alleviated.

Methods

An 85-year-old woman presented with regurgitation of enteral nutrients and recurrent respiratory infections after PEG placement. The patient suffered a cerebral infarction, and underwent PEG insertion on May 4, 2001, at a local hospital. After commencing PEG tube feeding, the following symptoms repeatedly occurred: regurgitation of the enteral feed; leakage of nutrients from the PEG tube insertion site; vomiting followed by pyrexia; dyspnea during the administration of nutrients, and pneumonia confirmed by chest X-ray. The patient often showed facial signs of discomfort during the feed administration. Liquid enteral nutrients were given in a sitting position at all times.

As the complications gradually became more frequent in occurrence, on October 21, 2001, we commenced giving her half-solid enteral nutrients which were prepared by mixing market-available enteral nutrients and agar powder. Half-solid nutrients were prepared by mixing 5 g agar powder with 500 ml liquid nutrients diluted with the same volume of water (1,000 ml total volume). The mixture was distributed into 50-ml syringes and kept in a refrigerator until it was administered via the PEG tubing. The mixture was not liquefied in the stomach due to body temperature. The administration of half-solid nutrients was made by injecting them into the stomach en bloc (injection time <5 min). The patient was not forced to remain in a sitting position during and after the administration.

Results

The symptoms, other than pyrexia, disappeared immediately after the administration of half-solid nutrients, and pyrexia vanished 2 weeks later. Also, the signs of discomfort during the feed administration were no longer noted. We followed the patient for up to 6 months after the start of the half-solid enteral nutrients, and observed no recurrence of the symptoms (fig. 1). At present (February 2004), the patient still remains in a stable condition and no longer suffers from the complications observed before the commencement of half-solid nutrients.

Discussion

PEG feeding is accompanied by unique complications, which occur over a long-term clinical course [1-3]. An increase in vomiting is one of the most common complications [4]. GER is clinically manifested by recurrent vomiting or aspiration. The mechanism by which GER increases in frequency has not yet been clarified.

Ogawa et al. [5, 6] suggested that since the stomach cannot move independent of the abdominal wall after the formation of a gastric fistula, enteral nutrients remain in the stomach longer, thereby increasing the chance of GER. Gastrin, a potent facilitator of peristaltic movement, may not be sufficiently induced by the distension of the stomach seen with slow infusion rates of liquid nutrients. Thus enhanced GER may eventually result. Since the nutrients can be administered in a short time by

our method (<5 min), the stomach wall is expected to be distended to a greater degree and thus stimulate peristaltic movement.

Another disadvantage of slow feed infusion is that patients are forced to remain in a sitting position for long periods while the nutrients are administered, which is unfavorable in terms of the prevention of decubitus ulcers, which are commonly found in patients with PEG feeding.

One of the late complications after PEG tube placement is leakage from the PEG tube insertion site. This is a difficult problem to cope with. There are two causes of leakage: inappropriate fixation of the bumper (including the so-called buried bumper syndrome [7]), and a decrease in the elasticity of the fistular opening, which develops over a long period after PEG placement [8]. The leakage resulting from a decrease in elasticity is intractable. Simply increasing the tube diameter cannot solve this

problem [7, 9]. We found, however, that solidification of the enteral nutrients alleviated the leakage in the present case. This may simply be explained by the fact that the solidified nutrients could not be leaked out by the intragastric pressure through the narrow gap between the fistular pore and the tube.

So far, we have administered half-solid nutrients to 17 patients with PEG feeding and followed up the patients for 6 months. During the observation period, we confirmed significant reductions in the complications observed before the commencement of the half-solid nutrients (data not shown).

In conclusion, our experience indicates that the use of half-solid nutrients in PEG feeding and their rapid administration can substantially reduce the risk of GER and may eventually contribute to a reduction in complications as well as an improvement in the quality of life of the patients and their caregivers.

References

- 1 Dwolatzky T, Berezovski S, Friedmann R, et al: A prospective comparison of the use of nasogastric and percutaneous endoscopic gastrostomy tubes for long-term enteral feeding in older people. *Clin Nutr* 2001;20:535-540.
- 2 Kanie J, Shimokata H, Akatsu H, Yamamoto T, Iguchi A: Risk factors for complication following percutaneous endoscopic gastrostomy: Acute respiratory infection and local skin infection. *Dig Endosc* 1998;10:205-210.
- 3 Kanie J, Kono K, Yamamoto T, Akatsu H, Iguchi A: Gastro-esophageal reflux successfully treated with transgastrostomal jejunal tube feeding (in Japanese). *Nippon Ronen Igakkai Zasshi* 1997;34:60-64.
- 4 Kanie J, Kono K, Yamamoto T, et al: Usefulness and problems of percutaneous endoscopic gastrostomy in a geriatric hospital (in Japanese). *Nippon Ronen Igakkai Zasshi* 1998;35: 543-547.
- 5 Ogawa S, Ikeda N, Koichi K, et al: Improvement of gastroesophageal reflux by percutaneous endoscopic gastrostomy with special reference to a comparison with nasogastric tubes. *Gastroenterol Endosc* 1995;37:727-732.
- 6 Ogawa S, Suzuki A, Morita T: Long-term followed up cases with percutaneous endoscopic gastrostomy with special reference to evaluation in infection of respiratory tract and gastric emptying. *Gastroenterol Endosc* 1992;34: 2400-2408.
- 7 Klein S, Heare BR, Soloway RD: The 'buried bumper syndrome': A complication of percutaneous endoscopic gastrostomy. *Am J Gastroenterol* 1990;85:448-451.
- 8 Kanie J (ed): *Percutaneous Endoscopic Gastrostomy (PEG) Hand Book*, ed 1. Tokyo, Igaku-shoin, 2002, pp 57-58.
- 9 Gauderer MWL: Methods of gastrostomy tube replacement; in Ponsky JL (ed): *Techniques of Percutaneous Endoscopic Gastrostomy*. New York, Igaku-shoin, 1988, pp 79-90.



CORRESPONDENCE

Survival rate after percutaneous endoscopic gastrostomy in a long-term care hospital

Dear Sir,

We previously reported the mortality after percutaneous endoscopic gastrostomy (PEG) in a general hospital.¹ The results showed a higher survival rate (30-day survival rate: 92.5%, 1-year survival rate: 64.0%, 2-year survival rate: 55.5%, mean age \pm SD at PEG: 75.7 ± 14.1 years) than the results in other studies.²

In this study we surveyed the survival rate of 93 consecutive patients older than 65 years (mean age: 80.3 ± 7.4 years) who received PEG by reviewing their charts in a long-term care hospital. Because the hospital has an affiliated nursing home, home-visit nursing and day care centers for the frail elderly, we could track the record of survival in 84.9% of the post-PEG patients at the time of survey. The primary diagnoses whose symptoms required the patients to receive PEG were: cerebrovascular disease (61.3%), Alzheimer's dementia and/or vascular dementia (15.1%) and brain injury (4.3%). Most patients were severely disabled, showing a mean of $5.5 \pm 1.2/6$ on the score of Cognitive Performance Scale³ (only one patient showed intact cognitive performance) and a mean of $0.8 \pm 3.0/20$ on Barthel Index.⁴

Fig. 1 shows the Kaplan–Meier's survival curve after PEG. The survival rate was 88.9% at 30 days, 59.1% at 1 year and 52.0% at 2 years. The mean fully observed survival period was 382.3 ± 485.2 days. Age was a significant predictor for the survival period ($\beta = -18.7$, $P = 0.008$). The relative risks of serum total protein < 6.0 , white blood count $> 12,000$, and coexisting decubitus at the time of PEG for the death at 1 year after PEG was 1.33 (95% CI; 0.77–2.28, $P = 0.263$), 1.79 (95% CI; 1.10–2.93, $P = 0.080$) and 1.29 (95% CI; 0.78–2.13, $P = 0.228$), respectively.

The 30-days, 1-year and 2-year survival rates of post-PEG patients in a long-term care hospital were

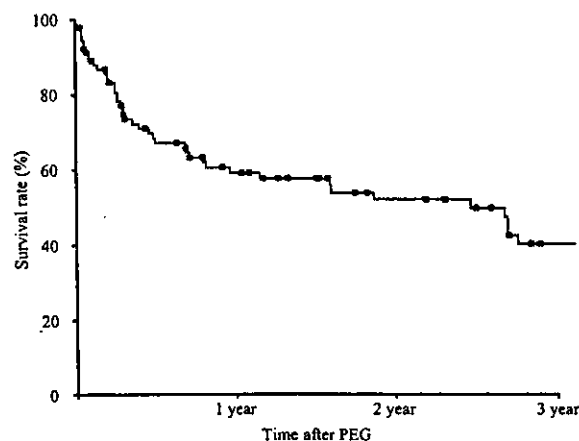


Figure 1 Kaplan–Meier survival curve after PEG. (●) Censored (dead) cases; PEG, percutaneous endoscopic gastrostomy.

lower than those in a general hospital. According to the 2002 annual report released by the Ministry of Health, Welfare and Labor of the government, the mean length of patients' hospital stay was 22.2 days in general hospitals, and 179.1 days in long-term care hospitals in Japan. By the current political pressure of shortening the length of stay in acute hospitals, the number of patients receiving PEG in long-term care hospitals has been constantly increasing. As shown in the results, the patients in long-term care hospitals usually have severe functional disabilities relative to those in acute hospitals. Under the circumstances, it is crucial to build up evidences regarding the post-PEG prognosis in long-term care hospitals.

In summary, the results indicate lower survival rates for post-PEG patients in a long-term care hospital than those in a general hospital. We believe that the present findings add some insights to the application of PEG in the long-term care.

References

1. Onishi J, Masuda Y, Kuzuya M, Ichikawa M, Hashizume M, Iguchi A. Long-term prognosis and satisfaction after percutaneous endoscopic gastrostomy in a general hospital. *Geriatr Gerontol Int* 2004;4(3), in press.
2. Finucane TE, Christmas C, Travis K. Tube feeding in patients with advanced dementia: a review of the evidence. *JAMA* 1999;282(14):1365-70.
3. Morris JN, Fries BE, Mehr DR, et al. MDS cognitive performance scale. *J Gerontol* 1994;49(4):M174-182.
4. Mahoney FI, Barthel DW. Functional evaluation: the Barthel Index. *Md State Med J* 1965;14:61-5.

Joji Onishi, Masafumi Kuzuya
Department of Geriatrics, Medicine in Growth and
Aging, Nagoya University Graduate School of
Medicine, 65 Tsurumai-cho, Showa-ku, Nagoya,
Aichi 466-8550, Japan
E-mail address: j-onishi@med.nagoya-u.ac.jp
(J. Onishi)

Hiromi Sakaguchi
Kobayashi Memorial Hospital, Japan

Available online at www.sciencedirect.com



The Relationship Between Functional Disability and Depressive Mood in Japanese Older Adult Inpatients

Joji Onishi, MD, Hiroyuki Umegaki, MD, PhD, Yusuke Suzuki, MD, PhD, Katsuhiko Uemura, MA, Masafumi Kuzuya, MD, PhD, and Akihisa Iguchi, MD, PhD

ABSTRACT

Depression is commonly found in older adult patients and is often associated with handicaps. The authors administered the Comprehensive Geriatric Assessment (CGA), including basic activities of daily living (BADL), instrumental activities of daily living (IADL), Mini-Mental State Examination (MMSE), Geriatric Depression Scale (GDS)-15, and a socioenvironmental questionnaire to 198 patients who were admitted to Nagoya University Hospital, to examine the relationship between depressive mood and various physical and socioenvironmental outcomes. The overall GDS-15 score was correlated with the BADL and IADL. The factor analysis extracted 4 factors from the GDS-15 subscales. The factors labeled "loss of morale and hope" and "memory loss and reduction of social activity" were highly correlated with both ADLs, social variables, and the MMSE score. The results reveal that factor analysis of GDS-15 will help in understanding the etiology of depressive mood, thereby contributing to better therapeutic approaches. (*J Geriatr Psychiatry Neurol* 2004; 17:93-98)

Keywords: depressive mood; Geriatric Depression Scale; Comprehensive Geriatric Assessment; factor analysis

Depression is one of the most insidious problems faced by older adults, and its incidence is increasing with the growth of an aging population. Koenig and Blazer reported that the prevalence of major depression was about 1% among community-dwelling older adults and that less severe depressive disorder was present in over 25%.¹ Moreover, they reported that the rate of major depressive disorder in older adult hospitalized patients with illness was more than 10 times greater than that of the unhospitalized aging population. Depression is not only psychologically traumatic but also quite costly² because it is related to psychosomatic symptoms resulting in a higher frequency of examination and prescription of drugs. Fur-

thermore, depression also decreases the morale of older people and increases the risk of being housebound. Although it is very important to adequately diagnose and treat depression in its early stage, it often remains unrecognized or untreated.³ One of the main reasons for this is that depressive symptoms often resemble those of the aging process itself, such as progressive cognitive deterioration or physical disabilities.⁴

The Geriatric Depression Scale (GDS) is a self-administered questionnaire with 30 items⁵ and is recommended by the Royal College of Physicians and British Geriatrics Society as a valid screening method for depression in older adults.⁶ A short form of the GDS (GDS-15) was developed later⁷ and was translated into Japanese.⁸ The validity and reliability of the GDS-15 have been confirmed in both community and hospital settings.⁹⁻¹¹ Several studies have subjected the GDS-15 data to a factor analysis, which is a statistical technique to analyze interrelationships within a set of variables, resulting in the construction of a few hypothetical variables. To our knowledge, however, there has been only 1 study involving factor analysis of the Japanese version of the GDS-15, reported by Schreiner et al in poststroke patients.¹² In addition, there have been few studies demonstrating the relationship between GDS-15 factor loading and disabilities in the older population.

Received September 4, 2003. Received revised December 22, 2003. Accepted for publication February 25, 2004.

From Department of Geriatrics, Nagoya University Graduate School of Medicine, Japan (Drs Onishi, Umegaki, Suzuki, Kuzuya, and Iguchi), and Department of Interpersonal Communication, Aichi Shukutoku University Graduate School of Communication Studies (Mr Uemura).

Address correspondence to: Joji Onishi, MD, Department of Geriatrics, Nagoya University Graduate School of Medicine, 65 Tsuruma-Cho, Showa-Ku, Nagoya, Aichi, 466-8550, Japan.

DOI: 10.1177/0891988704264738

The GDS-15 is included as one of the components in the Comprehensive Geriatric Assessment (CGA), a tool developed in the late 1980s^{13,14} to assess not only medical conditions but also overall functional status with respect to physical, psychological, and social problems of the older adults.

Although it is well known that depressive mood is often associated with functional disabilities, the mechanism by which the disabilities cause depressive mood in the older adults remains unclear. We hypothesized that some variables associated with functional disability may be associated with depressive mood. Therefore, we investigated the relationship between depressive mood and physical health and socioenvironmental variables in older adult inpatients. In addition, we attempted to clarify the structure of depression by performing a factor analysis of the GDS-15.

METHODS

Subjects

Among 355 consecutive patients aged 65 and older (mean age \pm SD: 77.3 \pm 6.8) who were admitted to Nagoya University Hospital between July 1998 and August 2001, patients who were admitted to nongeriatric wards were not included due to the absence of experienced CGA assessment team in the wards. Also, patients with communication impairments due to problems such as severe dementia or consciousness disturbance and patients under intensive care were not included in the study. If a patient was admitted more than once during the study period, only the data from the first admission was used for this analysis. As a result, 198 older adult patients in total were included in the study.

Measurements

The CGA was administered within a week after admission. The CGA included height; weight; Body Mass Index (BMI); blood pressure; basic activities of daily living (BADL), which were measured with the Barthel Index¹⁵; instrumental activities of daily living (IADL) using Lawton's scale¹⁶; Mini-Mental State Examination (MMSE)¹⁷; GDS-15; hearing ability and vision; communicative competence; and living environment including socioeconomic status. We scored IADL by 5 items (IADL-5), excluding food preparation, housekeeping, and laundry items from the Lawton's scale because the study samples included male patients, who did not normally perform these activities. The low scores of BADL and IADL-5 indicate greater functional disability. The GDS-15 is scored so that higher scores indicate a greater degree of depressive mood. The recent research clarified that the sensitivity of the GDS-15 was 97.3% and the specificity was 95.9% for screening major and minor depression when the cut-off score was set at 6/6+ in the Japanese geriatric population.¹⁸ Socioenvironmen-

tal status was assessed by Ozawa's scale,¹⁹ which includes items on economic, marital, family status, and the relationship between the patient and his or her family. The GDS-15 was self-administered by the patient. The attending nurse collected all other information by interview and/or assessment.

Statistical Analysis

Correlation coefficients were calculated by Pearson's method for parametric data and Spearman's for nonparametric data. We used the chi-square test with Yates correction and Fisher's exact test for categorical comparisons of the data. Differences in the means of continuous measurements between genders were tested using the Student's *t* test. In addition, after nonparametric data in the CGA were categorized into 2 groups (subjects with and those without a problem with respect to each parameter measured), the means of the continuous measurements between the groups were also compared by Student's *t* test. The internal consistency of the GDS-15 was calculated with Cronbach's alpha. Principal component analysis for the GDS-15 was performed with an eigenvalue of 1.0 or more as the extraction criterion, and factors were identified after Varimax rotation. The factor score, which shows the power of a factor's contribution, was calculated by regression method, which cumulated factor loadings of all items of GDS-15. In the present study, a higher score indicates a greater contribution of the factor to depressive mood. Differences in continuous variables among the disease groups were determined by 1-way analysis of variance (ANOVA). Tukey's test was used for multiple comparisons when homoskedasticity was assumed by Levene's method, and Dunnett's test was performed when homoskedasticity was not assumed. Multiple regression analysis, using the equation-building method with the variables of significant measures detected in the univariate analysis, was conducted to identify the variables contributing to GDS-15 scores. Values of $P < .05$ were considered to indicate statistical significance; all tests were 2-tailed. All statistical analyses were performed on a personal computer with the statistical package SPSS for Windows (Version 11.0 SPSS, Chicago).

RESULTS

Table 1 reports CGA variables for all patients, according to their diagnostic category. The mean GDS-15 score of all patients was 5.9 \pm 3.8 SD, and 39.3% of the patients had scores above 6. The homoskedasticities were assumed in age, systolic blood pressure, BADL, IADL-5, and GDS-15, but not in BMI or MMSE. Significant intergroup differences were observed on the BADL and IADL-5, but not in BMI, MMSE, or GDS-15. The BADL score in patients with diabetes mellitus was higher than that in patients with collagen disease ($P = .005$), and the IADL-5 score in patients with diabetes mellitus was higher than that in patients

Table 1. Mean Values ± Standard Deviation of Comprehensive Geriatric Assessment (CGA) Variables by Admitting Diagnosis

Admitting Diagnosis	n (%)	Age	BMI (kg/m ²)	sBP (mm Hg)	BADL	IADL-5	MMSE	GDS-15	GDS > 6
Neurological disease	40 (20%)	76.5 ± 6.6	20.9 ± 3.9	128.5 ± 23.7	16.9 ± 4.1	4.0 ± 1.3	24.9 ± 4.5	6.3 ± 3.7	42%
Cardiovascular disease	36 (18%)	77.7 ± 8.4	23.5 ± 3.8	132.8 ± 20.0	18.0 ± 3.7	4.0 ± 1.3	26.0 ± 4.3	5.7 ± 4.0	38%
Diabetes mellitus	34 (17%)	74.2 ± 5.3	23.5 ± 3.1	138.3 ± 19.4	19.0 ± 3.0*	4.5 ± 0.9*	26.6 ± 3.5	4.6 ± 3.5	27%
Psychological disease	20 (10%)	78.5 ± 6.5	20.0 ± 3.4	138.5 ± 22.3	17.9 ± 3.0*	3.1 ± 1.9*	22.4 ± 4.9	7.6 ± 3.8	15%
Gastroenterological disease	14 (7%)	78.9 ± 6.8	21.1 ± 4.8	132.3 ± 14.1	18.2 ± 3.2*	4.2 ± 0.9	25.9 ± 3.8	5.9 ± 4.7	64%
Collagen disease	12 (6%)	77.7 ± 5.1	21.6 ± 4.0	133.5 ± 20.6	14.2 ± 6.5*	3.3 ± 1.7	23.7 ± 4.7	5.4 ± 2.7	17%
Infectious disease	11 (6%)	83.1 ± 4.7	19.9 ± 3.0	122.0 ± 15.7	19.5 ± 0.8	4.8 ± 0.4	27.3 ± 2.8	2.8 ± 1.8	0%
Others	31 (16%)	78.0 ± 7.6	20.7 ± 3.5	142.4 ± 29.0	18.0 ± 3.9	4.3 ± 1.1	26.1 ± 4.1	6.3 ± 4.0	43%
Total	198 (100%)	77.3 ± 6.8	21.9 ± 3.8	133.9 ± 21.7	17.8 ± 3.8	4.1 ± 1.3	25.5 ± 4.3	5.9 ± 3.8	39%

Note: BMI = body mass index, sBP = systolic blood pressure, BADL = basic activities of daily living, IADL = instrumental activities of daily living, MMSE = Mini-Mental State Examination, GDS = Geriatric Depression Scale.

*P < .05.

Table 2. Principal Components (Varimax) Factor Analysis of the Geriatric Depression Scale-15

Items	Factor 1 Unhappiness	Factor 2 Apathy and Anxiety	Factor 3 Loss of Hope and Morale	Factor 4 Memory Loss and Reduction of Social Activity
1. Satisfied	0.708	0.270	0.061	-0.266
2. Dropped activities	0.058	0.646	0.350	-0.020
3. Emptiness	0.299	0.621	-0.134	0.179
4. Often bored	0.151	0.675	0.140	0.233
5. In good spirits	0.627	0.216	0.129	0.216
6. Afraid something bad will happen	0.336	0.572	0.163	-0.100
7. Feels happy	0.769	0.027	0.128	0.101
8. Often feels helpless	-0.186	0.536	0.493	0.013
9. Prefers to stay in	0.009	0.095	0.385	0.445
10. More problems with memory than most	0.082	0.074	0.043	0.805
11. Wonderful to be alive	0.553	0.077	0.458	0.033
12. Feels worthless	0.348	0.108	0.605	0.242
13. Full of energy	0.061	0.063	0.753	0.002
14. Feels situation is hopeless	0.270	0.235	0.679	0.090
15. Most people better off than self	0.487	0.396	0.013	0.368
Explained variance	2.4	2.2	2.2	1.2
Cumulative percentage of variance explained	16.6	31.5	46.3	54.8

Note: The factor score was calculated by regression method, which cumulated factor loadings of all items of GDS-15. Loadings in italic bold indicate those selected to define the factor.

with psychological disease ($P = .009$). The patients with psychological disease showed the highest mean score of GDS-15, (7.6 ± 3.8 SD). No significant intersex difference was observed in all parameters examined. Antidepressants had been administered to 7.2% of all patients, and to 9.0% of the patients with a GDS-15 score greater than 6.

The internal consistency of GDS-15 was found to be satisfactory, Cronbach's alpha being .83. Factor analysis of GDS-15 extracted 4 factors, whose loading values are shown in Table 2. The cumulative percentage of variance

Table 3. Correlation Between Geriatric Depression Scale-15, Extracted Factors, and Parametric Data

Measure	GDS-15	Factor 1 Unhappiness	Factor 2 Apathy and Anxiety	Factor 3 Loss of Hope and Morale	Factor 4 Memory Loss and Reduction of Social Activity
Age	0.123	-0.001	-0.108	0.250**	0.166*
BMI	-0.141	0.006	-0.135	-0.121	-0.036
sBP	-0.038	-0.260	-0.040	-0.009	-0.101
BADL	-0.168*	-0.033	-0.044	-0.191*	-0.055
IADL-5	-0.201**	-0.076	0.023	-0.235**	-0.066
MMSE	-0.151*	-0.034	0.050	-0.167*	-0.214**

Note: Pearson's rho used for correlations. BMI = body mass index, sBP = systolic blood pressure, BADL = basic activities of daily living, IADL = instrumental activities of daily living, MMSE = Mini-Mental State Examination.

*P < .05. **P < .01.

explained was 57.3%. Factor 1 represented "unhappiness," which included the items satisfied, in good spirits, feels happy, wonderful to be alive, and most people better off than self. Factor 2, "apathy and anxiety," was made up of the items, dropped activities, emptiness, often bored, afraid something bad will happen, and often feels helpless. Factor 3, "loss of hope and morale," included the items feels worthless, full of energy, and feels situation is hopeless. Finally, factor 4, "memory loss and reduction of social activity," included the items prefers to stay in and more problems with memory than most.

Pearson's coefficients of continuous variables are shown in Table 3. The total GDS-15 score had a significant negative correlation with IADL-5 ($r = -.201, P = .005$), BADL ($r = -.168, P = .021$), and MMSE ($r = -.151, P = .034$). However, there was no significant relationship between the GDS-15 score and age, BMI, or systolic blood pressure.

The score of factor 3 (loss of hope and morale) correlated positively with age and negatively with IADL-5, BADL, and MMSE scores, whereas factor 4 (memory loss and reduction of social activity) showed a significant positive correlation with age and a significant negative correlation with MMSE score. However, there was no significant relationship between the scores of factor 1

Table 4. Relationship of Nonparametric Data in Comprehensive Geriatric Assessment With the Geriatric Depression Scale-15 and Extracted Factors

Measurement	Percent With Problem	Spearman's ρ With GDS-15	t Test for Mean Score GDS-15	Factor 1 Unhappiness	Factor 2 Apathy and Anxiety	Factor 3 Loss of Hope and Morale	Factor 4 Memory Loss and Reduction of Social Activity
Gender (male/female)	—	—	NS	NS	NS	-0.22/0.17**	NS
BADL (with/without problem)							
Grooming	7.1%	—	NS	NS	NS	0.75/-0.08**	NS
Feeding	8.1%	-0.087	NS	NS	NS	NS	NS
Bowel continence	12.2%	-0.062	NS	NS	NS	NS	NS
Using toilet	14.2%	-0.122	NS	NS	NS	NS	NS
Ambulation	16.8%	-0.102	NS	NS	NS	0.31/-0.09*	NS
Chair/bed transfer	16.8%	-0.142	7.1/5.6*	NS	NS	NS	NS
Dressing	17.8%	-0.122	NS	NS	NS	NS	NS
Bladder control	19.8%	-0.097	NS	NS	NS	NS	NS
Bathing	25.0%	—	6.9/5.5*	NS	NS	0.27/-0.12*	NS
Using staircase	29.9%	-0.271*	7.4/5.2**	NS	NS	0.33/-0.17**	NS
IADL (with/without problem)							
Going outside	10.4%	—	NS	NS	-0.41/0.10*	NS	NS
Using telephone	11.4%	—	NS	NS	NS	NS	NS
Managing money	20.3%	—	NS	NS	NS	NS	NS
Medication	37.1%	—	NS	NS	-0.14/0.15*	NS	NS
Shopping	39.4%	—	NS	NS	NS	0.21/-0.15*	NS
Physical (with/without problem)							
Seeing	23.1%	-0.141	NS	NS	NS	NS	NS
Hearing	23.0%	-0.091	NS	NS	NS	NS	NS
Communication	7.0%	-0.152*	8.2/5.7*	NS	NS	NS	0.51/-0.48*
Social							
Economic status (dependent/independent)	—	-0.163*	NS	NS	NS	NS	NS
Marital status (with/without spouse)	—	-0.148*	NS	NS	NS	0.20/-0.21**	NS
Familial status (alone/not alone)	—	-0.136	7.2/5.6*	0.50/-0.08*	NS	NS	NS
Family relation (with/without interaction)	—	-0.220*	NS	NS	NS	0.71/-0.03*	NS

Note: NS = not significant. t-test for mean score compared between 2 groups with or without problem for each item.

* $P < .05$. ** $P < .01$. Dashes indicate not calculated because the items have less than 3 alternatives

(unhappiness) or factor 2 (apathy and anxiety) and other CGA variables.

The patients were divided into 2 groups depending on their score for CGA variables. Then we compared the difference between the GDS-15 factor scores and these 2 groups using Student's *t* test. The correlations of nonparametric data with the score of GDS-15 and the extracted factors are shown in Table 4. The GDS-15 score had a significant negative correlation with BADL (using staircase), communicative ability, economic and marital status, and family relationship. Patients having problems in using the staircase, bathing, chair/bed transfer, and communication showed a significantly higher GDS-15 score than the patients without these problems ($P < .001$, $P = .041$, $P = .034$, $P = .028$, respectively). Also, patients living alone showed a significantly higher GDS-15 score than those not living alone ($P = .043$). The statistical analysis revealed that the score of factor 3 (loss of hope and morale) was significantly higher among women ($P = .007$). Factor 3 had a much stronger relationship with some variables of BADL and IADL-5, such as grooming, using staircase, ambulation, bathing, and shopping, than it did with other factors. On the other hand, factor 2 (apathy and anxiety) was

inversely correlated with going outside and managing medication.

Multiple regression analysis was performed to predict the score of GDS-15 with significant variables, which were using stairs, bathing, communicative ability, economic status, marital status, familial status, and the total score of MMSE. This analysis elicited a model with an adjusted R^2 of .144 ($P < .001$) (Table 5).

DISCUSSION

The mean GDS-15 score in this study was 5.9, which was higher than those in previous studies. In a recent study of 1343 Japanese community-dwelling older adults, the mean GDS-15 score was 2.0 and 23.7% scored 6 or higher.²⁰ Meanwhile, Patrick et al reported that the mean score of hospitalized patients in their geriatric rehabilitation unit was 3.8 ± 2.8 SD.²¹ The higher GDS-15 scores obtained in this study may imply that worsening medical conditions resulting in admission to the hospital relate to increased depressive symptoms. In particular, the neurological disease group showed the highest mean GDS-15 score, which is in line with findings in previous studies that depression

Table 5. Coefficients of Regression Model for Geriatric Depression Scale-15

Variable	β	Standardized β	T	P Value
Using stairs	-2.48	-0.48	-4.27	< .001
Bathing	2.59	0.29	2.44	< .001
Communicative ability	-0.57	-0.04	-0.558	.016
Economic status	-0.48	-0.07	-0.917	.577
Marital status	-0.34	-0.09	-1.25	.360
Familial status	-1.02	-0.17	-2.17	.211
MMSE	-0.04	-0.04	-0.55	.584

Note: MMSE = Mini-Mental State Examination. GDS-15 = $-2.48 \times (\text{Using stairs}) + 2.59 \times (\text{Bathing}) - 0.57 \times (\text{Communication}) - 0.48 \times (\text{Economic status}) - 0.34 \times (\text{Marital status}) - 1.02 \times (\text{Family status}) - 0.04 \times \text{MMSE}$. Total adjusted $R^2 = 0.144$, $P < .001$.

frequently occurs after stroke.^{10,22,23} In the present study, antidepressants were administered to only 9.0% of the patients who had a GDS-15 score of greater than 6, which supports claims that depression is overlooked by clinicians, or is not treated adequately.⁴

The results of this study are consistent with previous findings that physical disabilities relate to depressive symptoms.²⁴⁻²⁷ In the present study, the GDS-15 score was negatively correlated with the BADL and IADL. Three BADL items in particular, using staircase, chair/bed transfer, and bathing, had strong negative correlations with the GDS-15 score. These results indicate that loss of lower body strength and impaired mobility may affect patient's mood. A possible explanation for the difference is that depressive mood may be associated with impaired abilities to maintain normality in life such as immobility, rather than the severity of disabilities.

We also found a weak but significantly negative correlation between the GDS-15 and MMSE scores. The findings of previous studies regarding the relationship between depression and the severity of dementia are varying, which may be attributable to differences in study design.²⁸ Although many investigators have reported a decrease in the frequency of depression in advanced dementia,^{29,30} no such association was found in this study probably because the cognitive impairment of the patients in this study was rather mild with mean MMSE score of 25.5 ± 4.3 SD, and no patients with advanced dementia were included.

Liu et al reported that being female, older, and without spouse were related to depressive symptoms among Chinese older adults.³¹ Our results did not demonstrate a significant relationship between the GDS-15 score and either gender or age, but a higher GDS-15 score was significantly related with economic dependence, absence of spouse, and poor family relationship particularly with "living alone."

Thus far, many researchers have reported on the factor analysis of GDS-15, but the relationship between the factors extracted and the physical, psychological, and socioenvironmental status of the older adults has not been extensively investigated. We found that factor 3, "loss of

morale and hope," was highly related with BADL and IADL. Meanwhile, factor 4, "memory loss and reduction of social activity," was related with age and MMSE, although factor 1 (unhappiness) and factor 2 (apathy and anxiety) were not correlated with any of those parameters examined, which means they may be normal aspects of disabled state and hospitalization. Some investigators have reported that sense of loss or environmental change can induce depression in the aged.^{32,33}

GDS-15 is often included in CGA, which is a useful tool to comprehensively assess older adult patients. The meta-analysis conducted by Stuck et al demonstrated that CGA was effective in improving mortality and in reducing hospitalization.³⁴ However, there have been few studies using CGA results to identify specific clinical strategies for patient care. The present study demonstrates that factor analysis of GDS-15 helps health care staffs establish better therapeutic strategies for depressive mood of older patients. For example, the present findings suggest that intervention to assist in coping with the functional impairment may decrease depressive symptoms in subjects suffering from them. However, pharmacological interventions may be more appropriate for nondisabled patients.

In conclusion, we carried out a structural analysis of the GDS-15 in older adult inpatients and extracted 4 factors related with functional disabilities. Factor 3, "loss of morale and hope," and factor 4, "memory loss and reduction of social activity," were highly related with ADL, social variables, and cognitive impairment. In addition, the results suggest that factor analysis will allow improved assessment and medical support of older adult inpatients. Thus, we believe that the results have indicated an extended utility of the GDS-15 not only as a simple screening method for depressive mood but also as a tool for better therapeutic approaches.

References

1. Koenig HG, Blazer DG. Epidemiology of geriatric affective disorders. *Clin Geriatr Med* 1992; 8:235-251.
2. Luber MP, Hollenberg JP, Williams-Russo P, et al. Diagnosis, treatment, comorbidity, and resource utilization of depressed patients in a general medical practice. *Int J Psychiatry Med* 2000; 30:1-13.
3. Jackson R, Baldwin B. Detecting depression in elderly medically ill patients: the use of the Geriatric Depression Scale compared with medical and nursing observations. *Age Ageing* 1993; 22:349-353.
4. Hirschfeld RM, Keller MB, Panico S, et al. The National Depressive and Manic-Depressive Association consensus statement on the undertreatment of depression. *JAMA* 1997; 277:333-340.
5. Yesavage JA, Brink TL, Rose TL, et al. Development and validation of a geriatric depression screening scale: a preliminary report. *J Psychiatr Res* 1982-1983; 17:37-49.
6. Royal College of Physicians of London and British Geriatrics Society. *Standardised assessment scales for elderly people*. Report of Joint Workshops of the Research Unit of the Royal College of Physicians and the British Geriatrics Society, 1992.
7. Yesavage JA. The use of self-rating depression scales in the elderly. In Ponn LW (Ed.). *Clinical memory assessment of older*

- adults. Washington, DC: American Psychological Association, 1986:213-217.
8. Niino N, Imaizumi T, Kawakami N. A Japanese translation of Geriatric Depression Scale. *Clin Gerontol* 1991; 10:85-87.
 9. Cwikel J, Ritchie K. Screening for depression among the elderly in Israel: an assessment of the Short Geriatric Depression Scale (S-GDS). *Isr J Med Sci* 1989; 25:131-137.
 10. Herrmann N, Mittmann N, Silver I, et al. A validation study of the geriatric depression scale short form. *Int J Geriatr Psychiatry* 1996; 11:457-460.
 11. Almeida OP, Almeida SA. Short versions of the geriatric depression scale: a study of their validity for the diagnosis of a major depressive episode according to ICD-10 and DSM-IV. *Int J Geriatr Psychiatry* 1999; 14:858-865.
 12. Schreiner AS, Morimoto T, Asano H. Depressive symptoms among poststroke patients in Japan: frequency distribution and factor structure of the GDS. *Int J Geriatr Psychiatry* 2001; 16:941-949.
 13. AGS Public Policy Committee. Comprehensive geriatric assessment. *J Am Geriatr Soc* 1989; 37:473-474.
 14. Health and Public Policy Committee, American College of Physicians. Comprehensive functional assessment for elderly patients. *Ann Intern Med* 1988; 109:70-72.
 15. Mahoney FI, Barthel DW. Functional evaluation: the Barthel Index. *Md State Med J* 1965; 14:61-65.
 16. Lawton MP, Moss M, Fulcomer M, et al. A research and service oriented multilevel assessment instrument. *J Gerontol* 1982; 37:91-99.
 17. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975; 12:189-198.
 18. Schreiner AS, Hayakawa H, Morimoto T, et al. Screening for late life depression: cut-off scores for the Geriatric Depression Scale and the Cornell Scale for Depression in Dementia among Japanese subjects. *Int J Geriatr Psychiatry* 2003; 18:498-505.
 19. Ozawa T. Comprehensive geriatric assessment. *Jpn J Geriatr* 1996; 35:1-9.
 20. Muraoka Y, Oiji A, Ihara K. The physical and psychological and social background factor of elderly depression in the community. *Nippon Ronen Seishin Igakkai Zasshi* 1996; 7:397-407.
 21. Patrick L, Knoefel F, Gaskowski P, et al. Medical comorbidity and rehabilitation efficiency in geriatric inpatients. *J Am Geriatr Soc* 2001; 49:1471-1477.
 22. Kotila M, Numminen H, Waltimo O, et al. Depression after stroke: results of the FINNSTROKE Study. *Stroke* 1998; 29:368-372.
 23. Carson AJ, MacHale S, Allen K, et al. Depression after stroke and lesion location: a systematic review. *Lancet* 2000; 8:122-126.
 24. Aneshensel CS, Frerichs RR, Huba GJ. Depression and physical illness: a multiwave, nonrecursive causal model. *J Health Soc Behav* 1984; 5:350-371.
 25. Berkman LF, Berkman CS, Kasl S, et al. Depressive symptoms in relation to physical health and functioning in the elderly. *Am J Epidemiol* 1986; 124:372-388.
 26. Wells KB, Stewart A, Hays RD, et al. The functioning and well-being of depressed patients. Results from the Medical Outcomes Study. *JAMA* 1989; 262(7): 914-919.
 27. Ormel J, Rijdsdijk FV, Sullivan M, et al. Temporal and reciprocal relationship between IADL/ADL disability and depressive symptoms in late life. *J Gerontol B Psychol Sci Soc Sci* 2002; 57:338-347.
 28. Katz IR. Diagnosis and treatment of depression in patients with Alzheimer's disease and other dementias. *J Clin Psychiatry* 1998; 59(Suppl 9):38-44.
 29. Fischer P, Simanyi M, Danielczyk W. Depression in dementia of the Alzheimer type and in multi-infarct dementia. *Am J Psychiatry* 1990; 47:1484-1487.
 30. Rovner BW, Broadhead J, Spencer M, et al. Depression and Alzheimer's disease. *Am J Psychiatry* 1989; 146:350-353.
 31. Liu CY, Wang SJ, Teng EL, et al. Depressive disorders among older residents in a Chinese rural community. *Psychol Med* 1997; 27:943-949.
 32. No authors listed. Grief versus depression in elderly patients. *JAMA* 1979; 241:1558.
 33. Phifer JF, Murrell SA. Etiologic factors in the onset of depressive symptoms in older adults. *J Abnorm Psychol* 1986; 95: 282-291.
 34. Stuck AE, Siu AL, Wieland GD, et al. Comprehensive geriatric assessment: a meta-analysis of controlled trials. *Lancet* 1993; 23:1032-1036.



Effect of long-term care insurance on communication/recording tasks for in-home nursing care services

Yoshihisa Hirakawa^{a,*}, Yuichiro Masuda^a, Kazumasa Uemura^{b,1},
Masafumi Kuzuya^a, Akihisa Iguchi^a

^a Department of Geriatrics, Nagoya University Graduate School of Medicine, 65 Tsuruma-cho,
Showa-ku, Nagoya, Aichi 466-8550, Japan

^b Department of Internal Medicine, Nagoya University Graduate School of Medicine, 65 Tsuruma-cho,
Showa-ku, Nagoya, Aichi 466-8550, Japan

Received 15 June 2003; received in revised form 22 August 2003; accepted 22 August 2003

Abstract

The purpose of this research was to clarify the possible changes brought about by the introduction of the long-term care insurance system in terms of number of communication/recording tasks, related nursing services in use, and when and where these tasks were performed. By examining the detailed content of communication/recording tasks, this study also sought to explore the advantages of introducing information technology (IT) systems in nursing service settings. The study was designed before-and-after study in two sessions, February 2000 and August 2000, namely before and after the introduction of Japan's long-term care insurance system. Participants were clients using the institution's in-home nursing services and all staff in a medical institution located in the Mikawa region of Aichi Prefecture, Japan. Following measurements were performed: (1) nursing service in use, (2) type of job, (3) date and time, (4) from whom, (5) to whom, (6) communication tool and (7) content, related to a particular communication. Communication/recording tasks were frequently performed around the starting and closing time of services. Following the adoption of the new system, these tasks tended to occur mostly around the starting time of services. As for the staff, the involvement of the professional carers increased. Regarding content of communication/recording, reports, confirmation and instruction increased. In conclusion, the use of IT driven devices is recommended

* Corresponding author. Tel.: +81-52-744-2364; fax: +81-52-744-2371.

E-mail address: y.hirakawa@k8.dion.ne.jp (Y. Hirakawa).

¹ Tel.: +81-52-744-1997; fax: +81-52-744-2999.

to streamline the performance of communication/recording tasks as well as to ease the rush of these tasks thereby improving the quality of nursing services.

© 2003 Elsevier Ireland Ltd. All rights reserved.

Keywords: Long-term care insurance; Communication/recording task; Nursing service setting; In-home nursing care service; Information technology (IT)

1. Introduction

The aging of society is a phenomenon affecting many developed countries today (Itouji, 1996; Adachi, 1998; Hattori et al., 2000; David et al., 2001; Esping-Andersen, 2001; Robert, 2002), and the need to establish nursing care systems that adequately meet the increasing related demands is thus evermore pressing (Adachi, 1998; Hilary, 2001).

In April 2000, Japan introduced a social insurance system for elderly care based on the principle of Socialization of Elderly Care (Masuda et al., 2001; Matsuda, 2002), whereby the burden of the care for the elderly is shared by society as well as the family (Hattori et al., 2000; Hilary, 2001). Prior to the introduction of the system, some had predicted a shortage in nursing service provision (Ueda et al., 1994; Hashimoto, 1996; Itouji, 1996). A quantitative increase in nursing service demand was reported after the adoption of the system (Miyatake, 2001), and the shortage of services seems to have intensified.

Moreover, under this insurance system, the professional carers are faced with the additional task of administrating the service provision. In order to provide a greater range of services, more precise planning is needed, and care plans must be carefully implemented and evaluated. Additional exchanges of information or communication/recording tasks among the professional carer are also required. Such tasks include face-to-face conversations, record entries, telephone calls, facsimiles, voicemail, and others. With the increasing demand for nursing services covered by the insurance, the associated communication/recording tasks may lower the quality of nursing services.

With the rapid advance of information technology (IT) in recent years, the trend can be found in medical sectors as in many other industries toward improving operational efficiency of services with the help of IT driven management systems (Laerum et al., 2001; Stamouli and Mantas, 2001). These systems allow for efficient processing of electronic medical charts, order entry, administration of materials and laboratory results, etc. In nursing settings also, carers can resort to IT systems to reduce their communication/recording workload, thereby spending more time and energy providing nursing services.

The purpose of this research is to clarify the possible changes induced by the introduction of Japan's new insurance system in terms of number of communication/recording tasks, related nursing services in use, and when and where these tasks occurred. Furthermore, during the periods of time when significant increases in the number of communication/recording tasks were observed, the detailed content of communication/recording was examined to explore the possibility of introducing IT systems to improve the efficiency of the nursing service settings.

2. Methods

2.1. Subject and sessions of research

The subject of this research is a medical institution located in the Mikawa region of Aichi Prefecture, Japan. The institution consists of a clinic with a rehabilitation facility (Clinic), a geriatric intermediate care facility (GICF) (providing a certain amount of medical care), an In-home nursing support center, a helper's station, and a visiting care station, providing nursing services such as visiting medical care, visiting rehabilitation, rehabilitation for outpatients, visiting nutrition guidance, and short-stay services.

The research was conducted in two sessions in February 2000 and August 2000, namely before and after the nationwide introduction of the elderly care insurance system. At each session, all the communication/recording tasks that occurred in relation to nursing service provisions during a continuous 48 h were recorded.

Given the fact that no significant variation in terms of number of users on workdays was shown in a preliminary research, Tuesdays and Wednesdays were selected for both the February and August sessions.

2.2. Content of research

A fill-out-type questionnaire was designed and used for the research (see Fig. 1). The items to fill out were: (1) nursing service in use, (2) type of job, (3) date and time, (4) from whom/what, (5) to whom/what, (6) communication tools and (7) content. The entry was performed by the staff carrying out each particular communication task. A preliminary meeting was held for orientation and instruction as well as to identify any problems with the procedure. The management of the forms was conducted by off-duty staff trained in advance. They were stationed at each facility and their duty was to check and collect the forms as appropriate.

2.2.1. Category of nursing services in use

Utilized in-home nursing services in relation to specific communication tasks were categorized as follows: daycare service at clinic, daycare service at GICF, short-stay service at GICF, in-home helper service, visiting nursing, visiting nutrition guidance, visiting rehabilitation, visiting medication, and others.

2.2.2. Job type

The job types of the staff involved in communication tasks were categorized as follows: physician, nurse, pharmacist, radiological technologist, physical therapist (PT), occupational therapist (OT), trainer, professional carer, consultant, secretary, nutritionist, cook, driver, and others.

2.2.3. Date and time

The specific dates and times when communication tasks occurred were recorded.

2.2.4. From whom/what and to whom/what

When a communication event occurred, the names of the persons involved were recorded in the columns 'From' and/or 'To whom'. When information was referenced and/or recorded

Nursing service in use	Daycare at Clinic	Daycare at Center	Short-stay at Center	Helper	Visiting care	Visiting nutrition guidance	Visiting rehabilitation
User's name	Mr./Ms.			Home visit	(Nurse Pharmacist Others		
Entered by:				Medical Doctor			Radiological Technologist
Type of Job	PT	OT	Trainer	Nursing staff	Consultant	Office worker	
	Nutritionist	Cook	Driver	Others			
Date/hour of occurrence	Date: day, dd/mm/yy am./pm.		Hour: hh/mm				
From whom	Family	User	Staff		Others ()		
From what	Form/Notes/Voicemail/Others						
To whom	Family	User	Staff		Others ()		
To what	Form/Notes/Voicemail/Others						
Communication tool	Message	Face-to-face conversation	Voicemail	Notes	Wiseman barcode		Wiseman keyboard
	Extension	Outside line	Facsimile	Entry in charts	(Others)		
	Instruction (prescription)	Info	Report	Consultation	Record	Confirmation	
Brief content							

Fig. 1. Questionnaire on communication tasks.

in some medium such as recording forms, the type of medium was entered in the column 'To what' and/or 'From what'. Entries in the 'From/To whom' column indicate the involvement of some person categorized as family, user, staff or others. Entries in the 'From/To what' column indicate the involvement of some recording medium categorized as forms, notes, voicemail or others. Forms are any recording medium of paper such as medical records. Notes represent Notes[®], a groupware of Lotus. Groupware is any type of software designed for groups and for communication, combining various software for supporting collaboration among a group of people with functions such as email, document management and schedule management.

2.2.5. Communication tools/media

The communication tools/media used in communication/recording tasks were categorized as follows: message, face-to-face conversation, voicemail, Notes, Wiseman Barcode, Wiseman Keyboard, extension call, outside line call, facsimile, medical record entries, references to other forms, and others.

Wiseman Barcode[®] and Wiseman Keyboard[®] represent the utilization of the nursing information management system of Wiseman[®], making use of barcodes and keyboards, respectively, for data entry. Wiseman Barcode[®] barcodes date, treatment, person-in-charge of treatment, and vital signs, and then reads them via a reader device. Wiseman Keyboard[®] utilizes a keyboard for data input.

2.2.6. Content

The content of communication/recording was categorized as follows: instruction (prescription), information, report, consultation, record, confirmation and others. Information means an unofficial communication which does not require reporting or recording.

2.3. Analysis

The changes between the two sessions of research were analyzed in terms of number of users, number of occurrences of communication/recording tasks, and category of service in use in relation to communication/recording tasks that occurred. To eliminate the influence on the number of communication/recording tasks induced by the change in total number of users, the data of the same users (153) was analyzed in both sessions.

Further, for these 153 users, a detailed analysis was conducted for a period of time where a significant change in the number of occurrences of tasks was found.

Data analysis was performed by Statview 5.0. For testing statically significant differences, the chi-square test was utilized with $P < 0.05$ as criteria.

3. Results

3.1. Total number of users and number of occurrences of communication/recording tasks

Table 1 shows the total number of users and the number of occurrences of communication/recording tasks. The total number of users was 400 in February and 442 in the August