1）人はなぜ転ぶのか？ 落ちるのか？

加齢・病気・精神症状・視覚・栄養

国立長寿医療センター先端医療部
骨粗鬆症科医長　奥泉 宏康 おくいずみ・ひろやす

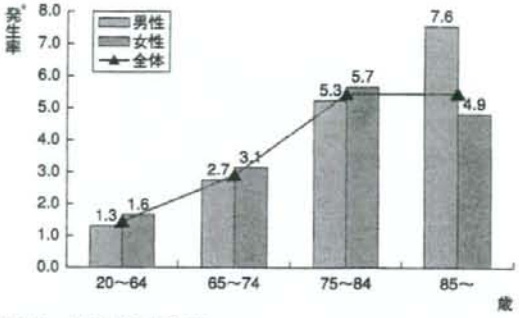
東京大学大学院
身体教育学講座教授　武藤 芳照 むとう・よしてる

はじめに

深夜のナースステーション。記録を必死で書いている横にはニコニコと微笑む患者さんが、今にもトイレに行こうと車椅子から立ち上がる姿が……。慌てて駆け寄る白衣の天使たち。ホッと胸をなでおろし、「今日はヒヤリハットを書かなくてすんだ～」とつぶやきます。

2007年2月、65歳以上人口が全人口に対して21.1％、75歳以上は9.1％となりました。今の世の中、5人に1人は高齢者なのです。年金問題も大問題ですが、高齢者が増加すると、入院患者さんも高齢化してきて、冒頭のような風景が当たり前のようになってきます。2005年の日本医療機能評価機構医療事故防止センターの報告[1]では、全医療事故報告1,063件/年のうち、治療処置309件に次いで、148件（14％）を転倒事故が占め、薬剤投与54件よりも多く、重大な事故につながっています。具体的には、転倒に伴って、死亡した人が5件、高度な障害の残存した人が21件見られています。

「転ばないで！」と頼んでも、転んでしまうのだから仕方ないと諦めずに、人はなぜ転ぶのかを考えていきましょう！　きっと、その中から、日常の看護に役立つ情報が得られるはずです。



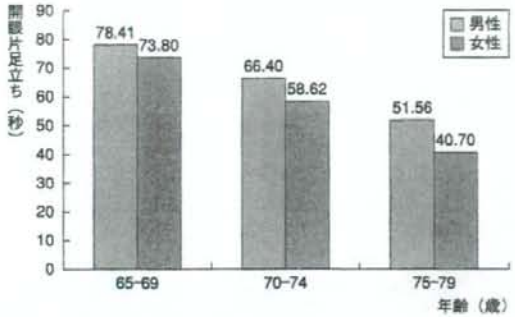
●図1　加齢と転倒発生率
＊（転倒件数/患者日数）×1000
男女とも加齢の影響あり、p＜0.01　＃：性差あり、p＜0.05

加齢による転倒増加と身体能力低下

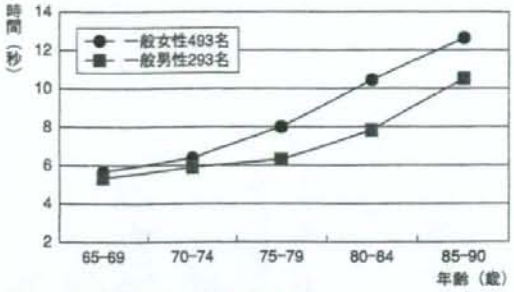
国立長寿医療センターは、病床数292床で小児科がない特殊な病院です。したがって入院患者の平均年齢は73歳と、通常の病院より高くなります。2004年8月より、「ヒヤリハット報告」とは別に、「転倒・転落調査票」を医師と看護師が必ず記載して提出するようにしました。その結果、2005年2月1日から2006年5月31日までの16カ月間で、518件の転倒・転落報告があり、月平均にすると32.4件となり、毎日誰かが転んでいることがわかりました。

年齢別にその時の入院患者に対しての転倒発生率を計算すると、**図1**のように、加齢に伴って転倒発生率は高くなっています。特に、65歳から84歳までは女性のほ

1)人はなぜ転ぶのか？ 落ちるのか？



●図2 加齢に伴う開眼片足立ちの変化
加齢に伴い、男性でも女性でも開眼片足立ちの時間は短縮。5歳ごとに約20％ずつ低下してくる。
文献1）より引用



●図3 年齢別の平均10m全力歩行時間
10mを歩行する時間（横断歩道を横断するくらいの距離）が、65-69歳の6秒から、85-90歳では10秒以上に延長している。

うがやや高い転倒発生率ですが、85歳を超えると男性のほうが女性より転びやすいという結果になっています。女性の平均寿命83歳に対して、男性では78歳なので足腰が弱くなっていても仕方ありませんよね。

それでは、足腰の強さって何でしょうか？

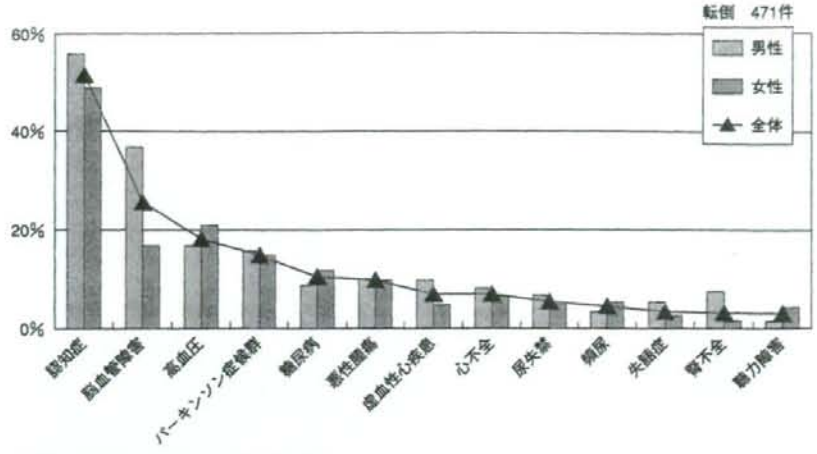
体力科学的に言えば、筋力の強さや持久力です。握力は30－35歳で男性49.2kg、女性29.9kgに対して、75－79歳でそれぞれ33.5kg、21.3kgに低下してきます。転倒しないようにするための、バランス能力の指標である「開眼片足立ち時間」[2]は、**図2**のように加齢とともに低下してきて、5歳ごとに約20％低下すると言われています。特に、高齢者の筋肉を調べてみると、遅く収縮して持続力のある赤筋（遅筋）より、早く収縮して大きな力を出す白筋（速筋）のほうが少なくなる傾向にあります。静かに立って、姿勢を保つための筋力のバランス機能である「開眼片足立ち時間」を評価しても低下しているので、瞬発力が必要となる転倒しそうになった時の「とっさの一歩」を出すことは、高齢者にとってかなり困難であると言えそうです。そのため、よろけたら自分で姿勢を回復することができずに、そのままズルズルと転倒・転落してしまうのです。

また、総合的な身体能力の評価方法である「健脚度」[3]については、後述されますが、その一つである「10m全力歩行」は青信号の間に横断歩道を渡れるのかをシミュレートした評価方法であり、**図3**のように80歳を超えた女性では、10mを歩くのに10秒以上かかるので、横断歩道を渡るにも焦ってしまうほどの運動能力しかありません。

さて、病院内での転倒・転落では、トイレ動作時にベッド周囲で発生することが多いと報告されています。入院患者の運動能力を評価すると、自立して歩行できるレベルから、車椅子やポータブルトイレを使用しているレベル、ベッド上での起座ができるレベル、寝たきりのレベルなどに分類されます。それぞれの身体活動範囲、身体活動度によって、転倒様式にも差が見られます。それぞれの患者の身体能力を把握することが、個々の転倒予防対策を立てる上で重要となります。

転倒に関連する病気や薬剤

高齢者は、多種多様な病気を持ち、1人で「高血圧」「糖尿病」「脳梗塞の既往」など、転倒に関連する病気を



●図4　65歳以上の転倒者の合併症の頻度
男女とも認知症合併者が半数を超えています。特に、脳血管障害に関しては男性により多く、女性の2倍の頻度でみられます。

併せ持っている場合があります。当院での転倒者の疾患別グラフ（**図4**）を参照してみましょう。

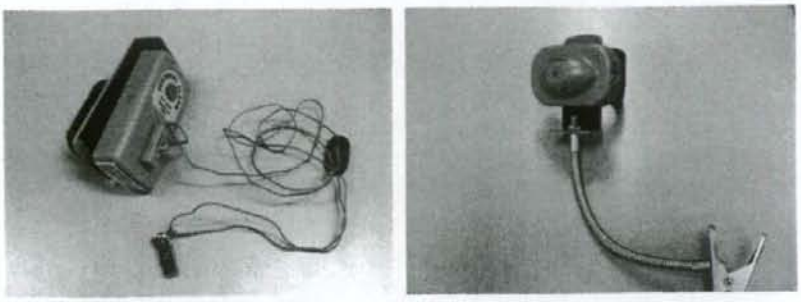
認知症が、男女とも半分を超える頻度に見られています。次いで、脳血管障害が男性で37％と、女性の17％の2倍以上となっており、性差が明らかになっています。脳血管性の認知症を合併していることもありますが、片マヒなどで身体機能が低下している方などが、車椅子やベッドから、「1人でできるか試してみようと思った」と、1人で移動して転倒する事例が多く見られています。実際に、一緒に移動をすることによって、個々の運動能力を患者さん自身に自覚してもらうことが必要です。

次いで、高血圧、パーキンソン症候群、糖尿病と続きます。高血圧はありふれた疾患であり、合併率が高いことは考えられますが、パーキンソン症候群は小刻み歩行などの特徴的な歩容や急に止まれないという疾患特性などが転倒の原因となっています。また、糖尿病の合併症として知られている末梢神経障害は、足底部での深部知覚を鈍らせ、足全体のバランスをとって姿勢を保持しようとする能力が低下します。また、これらの疾病は単独で存在するのでなく、高齢者になればなるほど重複する場合が多くなり、転倒リスクが上昇することは言うまでもありません。

病気に対して処方された薬剤自体が、転倒の危険因子となることがあります[4]。ハルシオンが「転倒」を副作用として明記していることは有名ですが、認知症に対して処方されるアリセプトにも、「転倒」の副作用があります。これらの薬剤は、眠気を誘ってめまいなどを生じることが問題ですが、さらに、軽度ながらも筋弛緩作用を有するために、転倒を引き起こす可能性があります。

また、薬剤を5種類以上内服していると、有意に転倒が多くなります。これは薬剤のみの副作用とは言い切れませんが、多種類の病気を有している患者さんは、多種類の薬剤も服用しているため、より転倒リスクが高くなります。したがって多種類の内服を行っている患者さんに対しては、薬剤の効果を見直し、不要な薬剤を整理して内服数を減量することが転倒予防に役立ちます。

1）人はなぜ転ぶのか？ 落ちるのか？



●図5 離床センサー
（左）クリップ式離床センサー、（右）赤外線式離床センサー
一般的には手軽なクリップ式センサーが用いられるが、患者さんの状態や性格によって、拘束感の少ない赤外線離床センサーも利用してみよう！

認知症と転倒

トイレ介助をしている間に、他の患者さんから呼ばれて、「ちゃんと、トイレが済んだら呼んでね！」とほんの数秒間、目を離したスキに転倒してしまった!! なんてことを、日常経験していませんか？

認知症の中核症状としては、「記憶障害」や「見当識障害」が認められます。その程度が、単なる「物忘れ」以上に、忘れていることさえ忘れてしまって何度も同じことを質問してみたり、仕事や家事などの社会生活に適応できなくなったりしている状態がこの病気の特質です。したがって、認知症の患者は「目の離せないやんちゃな子ども」のように、一つひとつの行動から目が離せなくなるのです。ナースセンターで、車椅子に乗った高齢者に囲まれながら記録を取る風景は苦肉の策ですが、1人でいると不安になってしまう認知症高齢者に対しては有効な手段です。でも、いくら「白衣の天使」でも……24時間、1人の患者に付きっきりなんて、仕事の少ないテレビドラマのヒロインにしかできませんよね。

そんな時には、離床センサーがいくらかの助けになります。衣服の襟に挟んで使用するクリップ式のセンサーが一般的ですが、個人への拘束感が不安を助長させることもあります。最近では、プライドを傷つけないために、マット式のものや赤外線式の離床センサー（**図5**）も利用されてきています。

また、徘徊や多動、暴言や、時にはつねられたりする暴力も、認知症の人にとっては、記憶がないために不安や焦燥感から生じる「当たり前の」行動なのです。むやみに抑制することは、むしろ不穏を煽ることになってしまいます。したがって、どうしても転倒が避けられない頻回の転倒常習者に対しては、衝撃吸収マットを敷いたり、ヘッドギアやヒッププロテクターなどを使用したりして、「せめて怪我だけはさせない！」という心構えが必要です。

視覚障害と転倒

日本での白内障の有病率は、初期変化まで含めると60歳代で70％、70歳以上で80％、80歳以上ではなんと98％と言われています。かすみがかってぼやけたり、昼間に眩しく見えたり、色の判別がつきにくかったりします。特に、コントラストが低下するため、床の段差や障害物に気づきにくく、つまずいて転んでしまうことが

あります。したがって、段差を少なくしたり、はっきりと色分けしたりして、わかりやすくする工夫が必要です。ベッド周囲を整理して、滑りやすいパイプ椅子やスリッパ、ゴミ箱などを片づけ、こぼしたお茶や小便などはこまめに拭いて、滑らないように環境整備しておくことが必要です。

また、夜間にトイレに起きて転倒するという患者さんが、就寝後から起床時までに限っても、全体の転倒の50％に及びます。夜間の視覚の確保は重要ですが、いくら眼が見えにくいからといっても、就寝時間を過ぎてまで、照明を点けておくわけにはいきません。トイレの周辺などに足元だけの自動点灯式ライトを設置したり、夜間に頻尿で起きることの多い患者さんのベッドサイドには、足元灯を点けたりしておくことが必要です。

栄養と転倒

最初に話したように、病気は転倒と関連していますが、健康な一般住民ではどうでしょうか？　地域高齢者での調査[5]で、転倒者には、BMI（体格指数）が大きく、ウエスト周囲やヒップ周囲が大きい、いわゆる肥満傾向が強い人が多かったと報告されています。さらに、中性脂肪や総コレステロールの値が高く、動脈硬化指数が高いことから、いわゆるメタボリックシンドロームの人に転倒が多いことが認められています。メタボリックシンドロームが転倒に関与するのか？　あるいはメタボリックで運動しないから転倒しやすいのか？　どちらなのかは定かでありませんが、健康診断や入院時検査で異常が認められる人は要注意です。

また、日光浴で皮膚でも生成されるビタミンD不足が、高齢者に見られる大腿骨頸部骨折や上腕骨・前腕骨の骨折を予防するという報告[6]があります。一般には骨や腸管に作用し、カルシウムを吸収して骨粗鬆症を予防する作用が知られていますが、筋肉に直接働いて転倒を予防する作用があるのではないかと考えられています。実際に転倒を予防するためには、日本で1日に推奨されている600単位のビタミンDでは十分ではありません。欧米の研究では800～1000単位のビタミンDを摂取するように勧められています。また、転倒が恐くなってあまり外出しないでいると、日光に当たることが少なくなり、ビタミンDがさらに低下してしまうことになります。体調に合わせて、無理のないように1日15分ほどの日光浴の習慣があるとよいでしょう！

まとめ

高齢者では、加齢とともに筋力・バランス能力が低下し、転倒しやすくなります。また、多数の病気を併せ持ち、特に、認知症や脳血管障害、パーキンソン病、糖尿病は転倒と関連性が高いと考えられています。さらに、病気のために5種類以上の内服を行っている高齢者は転倒により注意が必要であり、睡眠薬や安定剤、降圧剤な

1)人はなぜ転ぶのか？ 落ちるのか？

どは転倒と関連があります。

認知症の患者は不安や焦燥感から、1人にすると奇声を上げたり、徘徊、不穏行動により転倒することがあるので、基本的には身近に寄り添い、監視することが必要です。監視装置なども利用して、可能な限り1人にしないようにしましょう。転倒を避けられない場合には、骨折や頭部打撲などの外傷を最小限にとどめるように、保護装具を利用しましょう。

白内障を持つことが多い高齢者は、視力はもちろんのこと、特にコントラストの分解能が低下してくるので、足元の段差に注意し、ベッドサイドの整理整頓に心がけましょう。動脈硬化指数の高いメタボリックシンドロームの患者は転倒しやすいので、血液検査データから転倒リスクを評価するとともに、運動を奨励して、メタボリックシンドロームの改善にも気をつけましょう。特に、ビタミンDの不足している患者は、筋力やバランスの低下を伴い転倒しやすくなっているので、適宜ビタミンDの補給や日光浴などを行って、栄養状態を保てるように努力しましょう！

高齢者が転倒する特性や環境を熟知して、変えることについては可能な対策を積極的に実践し、高齢者の転倒・転落事故予防に役立てましょう！

引用・参考文献

1) 日本医療機能評価機構医療事故防止センター：医療事故情報収集等事業第9回報告書，日本医療機能評価機構公式ページ，日本医療評価機構，2007.（http：//www.jcqhc.or.jp/html/documents/pdf/med-safe/report_9.pdf）[2007.8.24確認]
2) 文部科学省スポーツ・青少年局生涯スポーツ課：「平成16年度体力・運動能力調査」の概要，文部科学省公式ページ，文部科学省，2005.（http：//www.mext.go.jp/b_menu/houdou/17/10/05101101.htm）[2007.8.24確認]
3) 武藤芳照・黒柳律雄・上野勝則他編著：転倒予防教室 転倒予防への医学的対応，日本医事新報社，p.89-97，2002.
4) 武藤芳照他編著：必ずできる！高齢者の転倒予防 リスク管理と実践ケアテクニック，コミュニティケア，7（6），p.39-43，2005.
5) 太田美穂・武藤芳照他：高齢者の転倒の実態と身体特性の関連，週刊日本医事新報，3837，p.26-32，1997.
6) Bischoff-Ferrari HA：How to select the dose of vitamin D in the management of osteoporosis，Osteoporos Int，18（4），p.401-407，2007.

RELATION OF FALLS EFFICACY SCALE (FES) TO QUALITY OF LIFE AMONG NURSING HOME FEMALE RESIDENTS WITH COMPARATIVELY INTACT COGNITIVE FUNCTION IN JAPAN

CHIKAKO KATO[1], KUNIO IDA[2], MORIO KAWAMURA[2] MASAHIRO NAGAYA[3], HARUHIKO TOKUDA[4], AKIKO TAMAKOSHI[5] and ATSUSHI HARADA[6]

[1] *Program in Physical and Occupational Therapy, Nagoya University Graduate School of Medicine, Nagoya 461-8673, Japan*

[2] *Department of Physical Therapy, Nagoya University School of Health Sciences, Nagoya 461-8673, Japan*

[3] *Department of Rehabilitation,*

[4] *Department of Clinical Laboratory,*

[5] *Department of Clinical Trials,*

[6] *Department of Orthopedic Surgery, National Center for Geriatrics and Gerontology, Obu City 474-8511, Japan*

Running head: RELATIONSHIP BETWEEN FES AND QOL

Corresponding author: Chikako Kato, M.S.
Program in Physical and Occupational Therapy, Nagoya University Graduate School of Medicine, 1-1-20 Daiko Minami, Higashi-ku, Nagoya 461-8673, Japan
Phone: +81 52 719 1365, Fax: +81 52 719 1509, E-mail: kato@met.nagoya-u.ac.jp

ABSTRACT

The purpose of this study was to investigate the relation of the Falls Efficacy Scale (FES) to quality of life (QOL) among nursing home residents. The subjects were 133 institutionalized women aged 70 years or older. They had comparatively intact cognitive function, with a Mini-Mental State Examination (MMSE) score of 15 or more, and could provide sufficient informed consent for a questionnaire survey. We evaluated their age, height, weight, body-mass index, history of hip fracture, history of fall(s) within the past year, complicating conditions, MMSE, Medical Outcomes Study 8-Item Short-Form Health Survey (SF-8), FES, and their subscores for Functional Independence Measure (FIM) motor items (self care, sphincter control, transfer, locomotion). There was a significant relationship between the Physical Component Summary (PCS) of SF-8 and FES. In each subscale, FES showed significant relations that were especially close in physical functioning (PF) and role physical (RP), with those relations proving stronger than those of the subscores of transfer and locomotion. In conclusion, the present results suggested that taking account of mental confidence is important for physical QOL, and that falls self-efficacy, including not only physical activity per se but also mental confidence, should be given prominence in the physical QOL of the institutionalized elderly.

Key Words: Falls Efficacy Scale, Fear of falling, Quality of life, Institutionalized elderly

INTRODUCTION

Although people live longer as a result of advances in economic development and medicine, a greater proportion of the population in aging societies is afflicted with chronic disease. Improving quality of life (QOL) through various interventions is thus a worthy goal. Efforts to prevent falls and fall-related trauma are one way to accomplish this goal. Falls and fractures are the third leading cause of the need for care in Japan, and this trend is particularly marked in elderly women.[1] Falls and fractures tend to turn "mobile" elderly into "immobile" elderly, and while their impact can significantly change QOL, that impact is not limited to the direct physical trauma; there are also long-term psychological effects, such as a fear of falling and depression.[2,3] Fear of falling was defined by Tinetti *et al.*[4] as a level of anxiety associated with falls sufficient to prompt people to avoid certain activities of daily living even though they are capable of performing them. Fear of falling in the elderly also leads to a downward spiral of decreased activity, accelerated deterioration of physical functioning, and a narrower range of activity,[2,5] and overall QOL will also be diminished.

There are two methods of measuring fear of falling: asking people directly about their fear, and the use of falls self-efficacy. The latter is represented by the Falls Efficacy Scale (FES),[6] which is a method of assessment that was developed based on the self-efficacy theory proposed by Bandura.[7] Although the method of asking directly about fear of falling is a simple one, neither its reliability nor validity has been sufficiently established. On the other hand, FES has proved to be both reliable and valid.[8] There have been studies on the relation between FES and QOL in the community-dwelling elderly.[9,10] Falls tend to occur more often among elderly people in Japan living in nursing homes (10–40%) than among those still residing in their own community (10–20%).[11] Among the nursing home elderly who experience many falls,[11] the fear of falling is greater,[2] and QOL will predictably be further diminished.

If the relation between fear of falling and QOL is strong, then it may be hoped that interventions to ease fear of falling would contribute to improving QOL. Such interventions among community-dwelling elderly are reportedly effective in the area of motor ability, particularly that which focuses on balance.[12] However, there are only a few reports on fear of falling in the institutionalized elderly [8,12] due to their often deteriorated cognitive function and physical infirmity. In Japan there are only reports dealing with motor functions,[13] but no reports that address the relation between fear of falling and QOL.

Therefore, as a first step toward improving QOL through interventions against fear of falling among the institutionalized elderly, we have investigated that relation using the FES, the reliability and validity of which have been adequately demonstrated.

METHODS

Subjects

The subjects for this study were 133 institutionalized female elderly with comparatively intact cognitive function, who had a Mini-Mental State Examination (MMSE) score of 15 or more, and could provide sufficient informed consent for a questionnaire survey. All subjects were participants in a broader clinical trial of hip protectors in nursing homes in Aichi Prefecture, Japan. Inclusion criteria for the clinical trial were: female sex, 70 or more years of age, not bedridden, and with at least 1 risk factor for falls or a hip fracture.[14] Those risk factors were: a history of hip fracture, history of fall(s) in the past year, and complicating conditions that predispose an elderly person to falls or fractures, i.e., heart disease, hypertension, previous stroke, diabetes mellitus, parkinsonism, arrhythmia, epileptic seizure, osteoarthritis, rheumatoid arthritis or a related condition, and eye disease (cataract or glaucoma).

Cross-sectional evaluation items

This cross-sectional analysis was conducted from November 2004 to November 2005. The cross-sectional evaluation items were age, height, weight, body-mass index (BMI), history of hip fracture, history of fall(s) in the past year, complicating conditions, MMSE,[15] Medical Outcomes Study 8-Item Short-Form Health Survey (SF-8),[16] FES,[6] and motor items on the Functional Independence Measure (FIM).[17]

SF-8 —QOL was assessed in an interview using the Japanese version of the SF-8,[16] which is a shorter version of the SF-36 and is used as a comprehensive and multidisciplinary measure of health status. The Physical Component Summary (PCS) and Mental Component Summary (MCS) were calculated using eight subscales: physical functioning (PF), role physical (RP), bodily pain (BP), general health perception (GH), vitality (VT), social functioning (SF), role emotional (RE), and mental health (MH). It was reported that PF, RP, BP and GH showed a strong relation to PCS, and that SF, RE, and MH evidenced a strong relation to MCS. As for VT, it shows a medium relation to both PCS and MCS. The reliability of the eight subscales of the Japanese version of the SF-8 is reportedly

0.56–0.87, while that of PCS is 0.77 and that of MCS 0.73.[16]

Falls Efficacy Scale (FES) —The FES was designed to assess the degree of perceived efficacy at avoiding a fall during each of 10 relatively non-hazardous activities of daily living (Taking a bath or shower, Reaching into cabinets or closets, Preparing meals that do not require carrying heavy or hot objects, Walking around the house, Getting in and out of bed, Answering the door or telephone, Getting in and out of a chair, Getting dressed and undressed, Light housekeeping, and Simple shopping).[6] Each response was scored on a scale of 1 (completely confident) to 10 (no confidence), with a high score (possible total point range 10–100) indicating low falls self-efficacy. The internal consistency was reported to be 0.90 (Cronbach's α),[18] and the reliability 0.71 (Pearson's correlation coefficient).[6] However, since the present study was conducted with nursing home residents as subjects, the items used were arranged to correspond to ADL in a nursing home setting: walking around the house was equated with participant walking in the vicinity of the bed, light housekeeping with cleaning around the bed, and simple shopping as at stores or stands on the nursing home premises. In order to ascertain the influence of this modification, nine participants (mean age 85.2 years) were retested after 2 weeks, and internal consistency or reliability was confirmed (Cronbach's α=0.91, Pearson's correlation coefficient = 0.72, p= 0.03).

FIM motor items—ADL was evaluated using FIM motor items[17] comprised of 6 self care activities (eating, grooming, bathing, dressing (upper body), dressing (lower body), toileting), 2 sphincter control items (bladder management, bowel management), 3 transfer items (transfers to bed/chair/wheelchair, to toilet, and to tub or shower), and 2 locomotion items (ambulation, stairs). Four subscores (self care, sphincter control, transfer, locomotion) were calculated. Each item was graded from fully assisted (1 point) to completely independent (7 points). In the present study, only ambulation was judged, although ambulation or wheelchair movement indoors was judged in the original method.[17]

Statistical methods

The SPSS 14.0 program was used for all statistical analyses, with less than 0.05 as the level of significance. Dependent variables were PCS, MCS, and the subscales. First, we examined the correlation between dependent variables and other variables [FES, age, BMI, history of hip fracture, history of fall(s) in the past year, total number of complicating conditions, MMSE, and the subscores for FIM motor items (self care, sphincter control,

transfer, and locomotion)) using Spearman's rank correlation coefficient (rho). Next, after adding significant variables to the correlation analysis and age to the multiple regression analysis (method of all possible combinations) with FES as explanatory variables, we calculated the standardized partial regression coefficient (β) to investigate the strength of the relation between FES and QOL.

As a secondary analysis, to determine the influence of past falls on QOL, a similar multiple regression analysis was conducted with PCS and MCS as dependent variables for two groups, one with 60 subjects and one without 73 subjects falls in the past year.

Ethical considerations

All participants gave written informed consent, and their names were coded from the start of the study through data collection and analysis so that no single individual could be identified. This study was approved by the Ethics Committees of both the Nagoya University School of Health Sciences and the National Center for Geriatrics and Gerontology.

RESULTS

Informed consent to participate in the hip protector clinical trial was obtained from 342 women in 35 nursing homes. However, 7 later refused to participate, 12 left the nursing home in which they were living before the cross-sectional evaluation, 135 had MMSE scores of 15 or less, and 55, even though their MMSE was above 15, lacked sufficient cognitive ability to provide informed consent for surveys using questionnaires. The present study was therefore conducted with the remaining 133 subjects.

The attributes of all 133 subjects were shown in Table 1. As for the results of correlation analysis, PCS showed significant correlations with FES, the total number of complicating conditions, MMSE, the subscore of transfer, and locomotion. Moreover, all SF-8 subscales and FES were significantly correlated, and MH was significantly correlated with BMI (Table 2). Table 3 shows the results of multiple regression analysis. PCS and FES showed a significant relation, while MCS did not. In each subscale, all subscales and FES showed significant relations; these were especially close between PF and RP, and were stronger than those for the transfer and locomotion subscores.

In a secondary analysis, the relation of FES to PCS in the group that had fallen in the past year was slightly weaker than in the group that had not done so (β of fall group= -0.35

vs. β of no-fall group= -0.38).

DISCUSSION

In the present study, the subjects were 133 institutionalized female elderly with a comparatively intact cognitive function. Because so many elderly nursing home residents suffer a diminished cognitive function, it can be difficult to select participants for surveys using questionnaires. Our subjects were women who scored 15 or higher on MMSE, since it was reported that "for patients with of MMSE 15, test-retest coefficients were better (range 0.53–0.90)" in the SF-36.[19] Of the total 133 subjects, 45.1% had experienced a fall within the past year. A high-risk group with such a high incidence of falling is predicted to have a greater fear of falling than elderly people living at home,[2] which further decreases their QOL. However, since the relation of FES to QOL in a high-risk fall group has not been investigated, we made it the subject of the present study.

The mean FES of nursing home elderly was 45.0 ± 22.3, against the 18.56 ± 9.04 of those reported still residing in the community or in intermediate care facilities.[6] That result was in line with our prediction that the falls self-efficacy of the institutionalized elderly would be lower than that for those still residents of a community (the lower the falls self-efficacy is, the higher the FES score).

Among the community-dwelling elderly, FES showed a significant relation to PCS,[10] with PF showing an especially high correlation in each subscale, followed by SF, BP, VT, and RP.[9] This study suggested that among the institutionalized elderly, similar to the community-dwelling elderly, FES was significantly related to PCS, and that among the subscales the relation was especially strong with PF and RP.

The relation of FES to PF and RP, as items related to physical QOL, was stronger than the relations of the transfer or locomotion subscores. It was previously reported that there is a strong relation between PF and transfer or locomotion ability.[20] So, in people such as the institutionalized elderly whose physical ability had clearly deteriorated, it was predicted that the transfer or locomotion subscores might strongly relate to PF and RP rather than FES. Interestingly, the relation of FES to PF and RP was stronger than the relations of either transfer or locomotion subscores. The FES is based on both physical ability judged by disease/disability and by mental confidence (self-efficacy),[6] with the latter being affected by four main information sources: "enactive mastery experience," "vicarious experience," "verbal persuasion," and "physiological and affective states." This information influences

mental confidence based on an individual's interpretation.[7] Since some type of care is needed in daily life for many nursing home residents, mental confidence tends to be readily influenced by the way a resident experiences that care. It is reported that interventions against fear of falling are effective among the community-dwelling elderly in the area of motor ability, particularly that which focuses on balance.[12] While it is important to attempt to reduce the fear of falling by improving physical function, it becomes more difficult to improve physical function in elderly people and chronic disease patients in care facilities. Therefore, for elderly care facility residents in particular, (a group with a high risk for falls that includes many people who require some type of care in daily life), considering mental confidence is important for physical QOL. We suggested that falls self-efficacy, including not only physical activity per se but also mental confidence, should be given prominence in the physical QOL of the institutionalized elderly. Although causal relationships could not be determined in this study since it was a cross-sectional analysis, we conjectured that raising falls self-efficacy might contribute to improving physical QOL.

In this study, as a secondary analysis, we conducted a similar multiple regression analysis with PCS and MCS for a group that had fallen in the past year and a group that had not. Friedman *et al.*[21] found that fear of falling is exacerbated by the experience of previous falls. It was predicted that the strength of the relation to PCS in the fall group would be greater than in the no-fall group. However, the relation of FES to PCS in the fall group was slightly weaker than in the no-fall group. Factors that have been suggested as related to fear of falling include the importance of life satisfaction[22] and decreased social activity.[10] Fear of falling may be influenced by various other factors in addition to the experience of falling. On the other hand, the possibility cannot be ruled out that FES excessively reflects psychological and social factors, while inadequately reflecting the fear of falling that accompanies falls.

Limitations of the present study include, first, the problem of sensitivity in evaluating QOL. In this study, SF-8, which can readily provide answers in a short time, was used to evaluate QOL. The correlation of the subscale score, which measures the same concept between SF-8 and SF-36, was as high as 0.56-0.87, thus supporting the reliability of SF-8.[16] Nevertheless, the accuracy of SF-8 measurements alone is undeniably inferior to that for SF-36. Next, There were also limits to FES evaluation of the institutionalized elderly in our study. Our subjects did not need to "prepare meals that required carrying heavy or hot objects," which was one of the standard FES items; moreover, there were other

items the elderly could not actually perform. They were also asked to respond to the question: "If you try, how confident are you in performing an act without falling?"[6] However, it is possible that some subjects, not wishing to admit to a "fear of falling," instead addressed the "likelihood of falling." In addition, since being female was a criterion for participation in the hip protector clinical trial, men were not analyzed. Differences between the sexes have been reported in the distribution and factors related to fear of falling,[22] so that the results of this study cannot be extrapolated to all elderly care institution residents.

In conclusion, FES was related to PCS, and that relation was particularly strong for the items of PF and RP, which were related to physical QOL. The strength of that relation was superior to that with the transfer or locomotion subscores. It becomes progressively more difficult to improve physical function in the institutionalized elderly because of their advanced age and chronic diseases. The results of the present study suggested that considering mental confidence is important for physical QOL, and that falls self-efficacy, including not only physical activity per se but also mental confidence, should be given prominence in the physical QOL of the institutionalized elderly. We expect that evidence for the effectiveness of interventions to reduce fear of falling and improve QOL among the nursing home elderly will be forthcoming in the not too distant future.

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REFERENCES

1) Ministry of Health, Labour and Welfare. Comprehensive Survey of Living Conditions of the People on Health and Welfare (2004). 2004, Tokyo.
2) Howland J, Peterson EW, Levin WC, Fried L, Pordon D, Bak S. Fear of falling among the community-dwelling elderly. *J Aging Health,* 1993; 5: 229-243.
3) Arfken CL, Lach HW, Birge SJ, Miller JP. The prevalence and correlates of fear of falling in elderly persons living in the community. *Am J Public Health,* 1994; 84: 565-570.
4) Tinetti ME, Powell L. Fear of falling and low self-efficacy: a case of dependence in elderly persons. *J Gerontol,* 1993; 48: 35-38.
5) Tinetti ME, Mendes de Leon CF, Doucette JT, Baker DI. Fear of falling and fall-related efficacy in relationship to functioning among community-living elders. *J Gerontol,* 1994; 49: M140-M147.
6) Tinetti ME, Richman D, Powell L. Falls efficacy as a measure of fear of falling. *J Gerontol,* 1990; 45: P239-P243.
7) Bandura A. Self-efficacy mechanism in human agency. *Am Psychol,* 1982; 37: 122-147.
8) Jorstad EC, Hauer K, Becker C, Lamb SE. Measuring the psychological outcomes of falling: a systematic review. *J Am Geriatr Soc,* 2005; 53: 501-510.
9) Lachman ME, Howland J, Tennstedt S, Jette A, Assmann S, Peterson EW. Fear of falling and activity restriction: The Survey of Activities and Fear of Falling in the Elderly (SAFE). *J Gerontol B Psychol Sci Soc Sci,* 1998; 53: 43-50.
10) Cumming RG, Salkeld G, Thomas M, Szonyi G. Prospective study of the impact of fear of falling on activities of daily living, SF-36 scores, and nursing home admission. *J Gerontol A Biol Sci Med Sci,* 2000; 55: M299-M305.
11) Yasumura S, Kanari Y. Epidemiology of falls and fractures among the elderly. *Bone,* 2003; 17: 237-241.
12) Zijlstra GA, van Haastregt JC, van Rossum E, van Eijk JT, Yardley L, Kempen GI. Interventions to reduce fear of falling in community-living older people: a systematic review. *J Am Geriatr Soc,* 2007; 55: 603-615.
13) Ikezoe T, Asakawa Y, Shima H, Tsuboyama T. Contributing factors influencing on fear of falling in frail elderly persons. *J Physical Medicine*, 2006; 17: 54-60.
14) Kannus P, Parkkari J, Niemi S, Pasanen M, Palvanen M, Järvinen M, Vuori I. Prevention of hip fracture in elderly people with use of a hip protector. *N Engl J Med,*

2000; 343: 1506-1513.

15) 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.

16) Fukuhara S, Suzukamo Y. Manual of the SF-8 Japanese version. pp.7-141, 2004, Institute for Health Outcomes & Process Evaluation Research, Kyoto.

17) Chino N, Liu M, Sonoda S, Domen K. Functional Evaluation of Stroke Patients. pp.43-95, 1997, Springer-Verlag, Tokyo.

18) Powell LE, Myers AM. The Activities-specific Balance Confidence (ABC) Scale. *J Gerontol A Biol Sci Med Sci, 1995;* 50A: M28-M34.

19) Novella JL, Jochum C, Ankri J, Morrone I, Jolly D, Blanchard F. Measuring general health status in dementia: practical and methodological issues in using the SF-36. *Aging (Milano)*, 2001; 13: 362-369.

20) Kanegane S, Hayashi C, Konuma M, Yamashiro S, Saiba M, Jufukuin S, Kitagawa K. Health-related quality of life and preferences for medical services of institutionalized elderly people. *Jpn J Prim Care*, 2001; 24: 118-125.

21) Friedman SM, Munoz B, West SK, Rubin GS, Fried LP. Falls and fear of falling: Which comes first? A longitudinal prediction model suggests strategies for primary and secondary prevention. *J Am Geriatr Soc*, 2002; 50: 1329-1335.

22) Suzuki M, Kanamori M, Yamada K. Incidence of, and factors related to, the fear of falling among the elderly living in their own homes. *Jpn J Geriatr Psychiatry*, 1999; 10: 685-695.

Table 1 Attributes of all 133 subjects.

Attribute	Mean	SD or (%)
Age	85.6	6.1
Height (cm)	145.0	7.2
Weight (kg)	44.4	8.3
BMI	21.1	3.6
History of hip fracture		(29.3)
Fall(s) in past year		(45.1)
Complicating conditions		
Heart disease		(25.6)
Hypertension		(47.4)
Previous stroke		(40.6)
Diabetes mellitus		(16.5)
Parkinsonism		(6.8)
Arrhythmia		(2.3)
Epileptic seizure		(0.8)
Osteoarthritis		(21.1)
Rheumatoid arthritis or related condition		(3.0)
Eye disease (cataract or glaucoma)		(27.8)
Total number of complicating conditions	1.9	1.1
MMSE (range: 0-30)	22.3	4.4
SF-8		
Physical Component Summary (PCS)	41.4	10.8
Mental Component Summary (MCS)	50.1	8.4
Physical functioning (PF)	42.3	12.0
Role physical (RP)	41.7	12.6
Bodily pain (BP)	46.2	10.7
General health perception (GH)	47.5	7.4
Vitality (VT)	48.6	7.4
Social functioning (SF)	48.2	8.8
Role emotional (RE)	47.0	10.7
Mental health (MH)	48.7	7.9
FES (range:10-100)	45.0	22.3

FIM motor items		
Subscore of self-care (range: 6-42)	33.0	7.6
Subscore of sphincter control (range: 2-14)	11.2	3.2
Subscore of transfer (range: 3-21)	15.7	4.2
Subscore of locomotion (range: 2-14)	7.0	3.6

SD=standard deviation; BMI=Body-mass index; MMSE=Mini-Mental State Examination; SF-8=MOS 8-Item Short-Form Health Survey; FES= Falls Efficacy Scale; FIM=Functional Independence Measure.

Table 2 Spearman's rank correlation coefficient (rho) between PCS, MCS, subscales and other variables.

	PCS	MCS	PF	RP	BP	GH	VT	SF	RE	MH
FES	-0.50*	-0.08	-0.53*	-0.51*	-0.31*	-0.23*	-0.32*	-0.25*	-0.21*	-0.27*
Age	0.13	-0.08	0.14	0.13	0.07	-0.02	-0.10	0.07	0.01	0.01
BMI	0.05	0.07	0.08	0.00	0.10	0.05	0.07	0.06	-0.03	0.20*
History of hip fracture	0.06	-0.11	-0.03	0.04	0.08	-0.01	0.02	-0.03	-0.00	-0.16
Fall(s) in past year	-0.06	-0.11	-0.07	-0.14	-0.05	-0.03	-0.07	-0.11	-0.11	-0.08
Total number of complicating conditions	-0.20*	0.07	-0.08	-0.17	-0.21*	-0.10	-0.02	-0.16	-0.02	0.01
MMSE	-0.25*	0.10	-0.20*	-0.14	-0.24*	-0.09	-0.04	-0.15	0.05	-0.04
Subscore of self care	0.07	0.12	0.09	0.13	-0.03	-0.01	0.16	0.03	0.15	0.09
Subscore of sphincter control	0.04	0.03	0.04	0.07	-0.13	-0.02	0.05	-0.01	0.06	0.01
Subscore of transfer	0.18*	0.09	0.19*	0.23*	0.07	0.08	0.18*	0.02	0.13	0.16
Subscore of locomotion	0.27*	0.09	0.29*	0.37*	0.14	0.02	0.18*	0.12	0.21*	0.19*

FES=Falls Efficacy Scale; BMI=Body-mass index; MMSE=Mini-Mental State Examination.

*$p<0.05$