

Research article/Raziskovalni prispevek

OUTCOME IN PATIENTS WITH FEMORAL NECK FRACTURES DEPENDS ON THE TREATMENT USED

KONČNI REZULTAT ZDRAVLJENJA STAROSTNIKA Z ZLOMOM VRATU
STEGNENICE JE POVEZAN Z METODO OPERACIJE

Drago Brilej,¹ Radko Komadina,¹ Miran Vrabl²

¹ Department of Traumatology, General and Teaching Hospital Celje, Oblakova 5, 3000 Celje

² Zavarovalnica Maribor d. d., Cankarjeva ul. 3, 2000 Maribor

Abstract

Background *Hip fractures among the elderly are related to a high degree of mortality and disability. The views of the treatment methods of elderly patients with femoral neck fractures are opposing.*

Patients and methods *In the 4-year period the General and Teaching Hospital Celje admitted 164 patients older than 65 years for treatment due to a dislocated femoral neck fracture (Garden 3,4). The patients were divided into two groups according to the fracture management approach. 52 patients were treated for dislocated femoral neck fracture through internal fixation with three screws (Group A). 81 patients were treated for dislocated femoral neck fracture through cemented bipolar partial prosthesis (Group B). The one-year survivability was examined and compared between the two groups. A multivariate analysis was used to examine the impact on the final outcome of the treatment and one-year survivability.*

Results *A good treatment outcome was reported in 44 % elderly managed with osteosynthesis and in 66 % patients treated with prosthesis. A cumulative one-year survivability rate was 64.6 % in patients treated with osteosynthesis while in patients treated with prosthesis the rate was 75.7 %. The pre-fracture medical condition (3.88 odds ratio), treatment approach (0.33 odds ratio) and clinical rehabilitation efficiency (0.07 odds ratio) had a statistically significant impact on the functional one-year post-fracture result. The age of the patients (0.30 odds ratio) and hospital rehabilitation efficiency (2.89 odds ratio) had a significant impact on the post-fracture survivability.*

Conclusions *The authors claim that a primary cemented partial bipolar prosthesis is the treatment choice for elderly with dislocated femoral neck fracture.*

Key words *elderly; femoral neck fracture; osteosynthesis; partial hip replacement*

Izveček

Izhodišča *Prebivalstvo Slovenije se stara. Med starostniki so zlomi kolkov pomemben vzrok umrljivosti in invalidnosti. Incidenca zlomov vratu stegenice dosega 25–30 na 100.000 prebivalcev letno. Mnenja o načinu zdravljenja starostnikov z zlomom vratu stegenice si nasprotujejo. Kar 94 % dislociranih zlomov vratu stegenice pri starostnikih na Nizozemskem zdravijo s hemiartroplastiko, v Švedski pa praktično vse primarno oskrbijo z osteosintezo. V SUB Celje so do leta 1994 večino dislociranih zlomov vratu stegenice oskrbeli z osteo-*

Corresponding author / Avtor za dopisovanje:

Drago Brilej, Department of Traumatology, General and Teaching Hospital Celje, Oblakova 5, 3000 Celje, Slovenia, fax: +386 35481204, e-mail: Drago.Brilej@guest.arnes.si

sintezo s tremi vijaki. Leta 1995 so spremenili protokol zdravljenja. Poškodovance, starejše od 65 let z dislociranim zlomom vratu stegenice so oskrbeli z delno cementirano bipolarno protezo. Obe skupini so primerjali med sabo, da bi ugotovili upravičenost menjave metode zdravljenja.

Hipoteza je bila, da vstavev delno cementirane bipolarne endoproteze izboljša preživetje starostnikov z dislociranim zlomom vratu stegenice in da preživelim omogoči uspešnejšo rehabilitacijo.

Bolniki in metode *V SUB Celje so od januarja 1993 do decembra 1996 zaradi svežega dislociranega zloma vratu stegenice (Garden 3,4) zdravili 164 poškodovancev, starejših od 65 let. Praviloma so v letih 1993 in 94 zdravili te zlome z osteosintezo s tremi vijaki, v letih 1995 in 96 z vstavitvijo delne bipolarne endoproteze. 131 (80 %) poškodovancev so spremljali 1 leto. Glede na način oskrbe zloma so jih razdelili v dve skupini. V letih 1993 in 94 so zdravili 52 starostnikov zaradi dislociranega zloma vratu stegenice z osteosintezo s tremi vijaki. V letih 1995 in 96 so zdravili 81 starostnikov zaradi dislociranega zloma vratu stegenice z delno cementirano bipolarno protezo. Pred operativnim posegom so ocenili zdravstveno stanje poškodovanca po ASA lestvici. Ugotavljali so zaplete med zdravljenjem in trajanje hospitalizacije. Ob koncu zdravljenja in po enem letu so ocenili samostojnost poškodovancev pri hoji. Z metodo po Kaplan Meier so ugotavljali 1-letno preživetje in ga z Log-Rank testom primerjali med obema skupinama. Z multivariantno analizo so ugotavljali vpliv neodvisnih spremenljivk na končni rezultat zdravljenja in na enoletno preživetje.*

Rezultati *V skupini A (osteosinteze) je bilo 52 poškodovancev. Povprečno trajanje hospitalizacije je bilo 18,75 dneva. Zapleti so se pojavili pri 11 (21 %) poškodovancih. V bolnišnici so umrli štirje (8 %) poškodovanci. Ob odpustu iz bolnišnice je bilo 18 (37,5 %) poškodovancev samostojnih pri hoji. Eno leto po poškodbi so analizirali 43 poškodovancev (89,6 %). Pri 16 (33,5 %) poškodovancih so se pojavile motnje celjenja zloma (pseudoartroza, avaskularna nekroza glavice stegenice). Dober rezultat zdravljenja po enem letu je bil ugotovljen pri 19 (44 %) starostnikih z zlomom vratu stegenice, zdravljenih z osteosintezo. V skupini B (proteze) je bilo 81 poškodovancev. Povprečno trajanje hospitalizacije je bilo 17,8 dneva. Zapleti so se pojavili pri 14 (17,3 %) poškodovancih. Umrljivost v bolnišnici je bila 7,5 %. Eno leto po poškodbi smo analizirali 68 poškodovancev (89,5 %). Ponovnih operativnih posegov na operiranem kolku ni bilo. Dober rezultat zdravljenja po enem letu je bil ugotovljen pri 45 (66 %) poškodovancev. Kumulativno enoletno preživetje poškodovancev z zlomom vratu stegenice in osteosintezo je bilo 64,6 %, pri poškodovancih s protezami 75,7 %. Zdravstveno stanje pred poškodbo (razmerje obetov 3,88), metoda zdravljenja (razmerje obetov 0,33) in uspešnost bolnišnične rehabilitacije (razmerje obetov 0,07) so statistično signifikantno vplivali na funkcionalni rezultat eno leto po poškodbi. Starost poškodovanca (razmerje obetov 0,30) in uspešnost bolnišnične rehabilitacije (razmerje obetov 2,89) sta statistično signifikantno vplivala na preživetje po poškodbi.*

Zaključki *Cilj zdravljenja starostnika z zlomom vratu stegenice mora biti zgodnja mobilizacija in možnost obremenjevanja operirane noge. Le-to mu omogoča hitro vrnitev v njegovo socialno okolje. Prednost oskrbe zloma vratu stegenice s cementirano bipolarno endoprotezo je v tem, da lahko starostnik nogo takoj polno obremenjuje, ponovnih operacij je malo (0,4–4 %). Rezultati analize v SUB Celje so pokazali, da so zdravstveno stanje pred poškodbo, metoda zdravljenja in uspešnost bolnišnične rehabilitacije statistično signifikantno vplivali na funkcionalni rezultat eno leto po poškodbi. Rezultati analize v SUB Celje so tudi pokazali boljše enoletno preživetje tistih starostnikov, ki so bili operirani s protezo (razlika 11,1 %), vendar razlika ni bila statistično značilna. Med bolnišničnim zdravljenjem ni bilo pomembnih razlik v zapletih in umrljivosti poškodovancev. Statistično pomemben vpliv na enoletno preživetje sta imela starost poškodovancev in uspešnost rehabilitacije v bolnišnici. Ocenjujemo, da je zdravljenje dislociranega zloma vratu stegenice pri starostnikih s cementno delno bipolarno protezo boljše kot osteosinteza in predstavlja kirurško metodo izbora.*

Ključne besede *starostniki; zlom vratu stegenice; osteosinteza; delna proteza*

Introduction

The number of people in Slovenia aged 65 and older is projected to increase by 50 % over the next 20 years to reach 19 % of the whole population.¹ Hip fractures among the elderly are related to a high degree of mortality and disability. The incidence of femoral neck fractures is approximately 25–30 per 100,000 people annually.² The mortality rate among the hip fracture patients is nearly 30 % in the first post-fracture year and only half of those who survive manage to regain their pre-injury level of function.³ It has been estimated that the overall costs of treatment in the USA account for about \$ 16,000–20,000 per patient.⁴

The views of the treatment methods of elderly patients with femoral neck fractures are opposing. In the Netherlands, as many as 94 % of dislocated femoral neck fractures in elderly are treated with hemiarthroplasty, while in Sweden practically all are treated with osteosynthesis.⁵

At the General and Teaching Hospital Celje («SUB Celje») until 1994 most of the dislocated femoral neck fractures were treated by osteosynthesis with three screws. In the year 1995, the treatment protocol was changed. The patients older than 65 years were treated with cemented bipolar prosthesis for dislocated femoral neck fracture. The comparison of the two groups was made in order to examine the reasons for practice variation.

The hypothesis was that the use of a cemented bipolar endoprosthesis contributed to the survivability of elderly patients with dislocated femoral neck fracture and to the efficiency of their rehabilitation.

Patients and methods

In the period between January 1993 and December 1996 the General and Teaching Hospital Celje admitted 164 patients older than 65 years for treatment due to a dislocated femoral neck fracture (Garden 3,4). In the years 1993 and 1994, such fractures would normally be treated with osteosynthesis through internal fixation with three screws, and in the years 1995 and 1996, using the bipolar endoprosthesis. A 1-year follow-up study of 131 patients (80 %) was conducted. The patients were divided into two groups according to the fracture management approach.

Group A

In the years 1993 and 1994, fifty-two elderly patients were treated for dislocated femoral neck fracture with osteosynthesis through internal fixation with three screws. The mean age of the patients was 79.7 years with 16 of them being male and 36 female. Forty-nine percent of the patients were operated within two days after the injury. After the closed reposition on the extension table under the control of the radiological amplifier the fracture was stabilised with three parallel spongy screws.⁶ The patients were mobilised out of bed by the first post-operative day and with the assistance of physiotherapists they were taught to walk using crutches and to apply the weight bearing restrictions on the operated leg. The outpatient fol-

low-up was conducted at 6-week intervals until the fracture healing or occurrence of any healing disturbances (redislocation, pseudoarthrosis, avascular necrosis). Full weight bearing was normally allowed 2–3 months after the fracture.

Group B

In the years 1995 and 1996 eighty-one patients were treated for dislocated femoral neck fracture through cemented bipolar prosthesis. The average age of the patients was 79.2 years, with 14 of male and 67 of female gender. The cemented bipolar prosthesis was anchored using either the lateral or anterolateral approach according to Watson Jones.⁷ The patients were mobilised out of bed by the first post-operative day and with the assistance of physiotherapists they were taught to walk using crutches. Full weight bearing of the operated leg was allowed.

The pre-surgical physical condition of the patients was assessed using the ASA scale.⁸ Analysed were any complications during the treatment and the duration of hospitalisation. At the end of the treatment the functional independence of the patients was assessed: 1 (immobile), 2 (walking using crutches or with the assistance of another person), 3 (independent mobility using crutches), 4 (totally independent mobility). The patients assessed with 3 and 4 were considered as independent when walking.

Independence in walking was analysed again one year after the fracture. If the elderly needed assistance in walking (score 1 and 2) and if re-operation was required of the injured hip (fracture healing disturbances, replacement of prosthesis), this was assessed as a poor treatment outcome.

The Kaplan Meier method was used to examine the one-year survivability to be compared through the Log-Rank test between the two groups.⁹ A multivariate analysis was used to examine the impact of independent variables on the final outcome of the treatment and one-year survivability.¹⁰ The dependent variable was the functional result after one year (dichotomous variable: good, bad). The independent variables were age (dichotomous variable: 65–75 years, > 75 years), pre-fracture mobility (dichotomous variable: independent, dependent), pre-fracture medical condition according to the ASA scale (dichotomous variable: 1 and 2, 3 and 4), treatment method (dichotomous variable: osteosynthesis or prosthesis) and level of function upon discharge (dichotomous variable: independent, dependent). The analysis was made using the SPSS program (Statistical package for social sciences, SPSS Inc.). The values $p < 0.05$ were regarded as statistically typical.

Results

Group A (osteosynthesis) comprised 52 patients. The average hospitalisation duration was 18.75 days. The complications occurred in 11 patients (21%): three suffered from pneumonia, two from stomach ulcer haemorrhage, two had a heart failure, one case of deep venous thrombosis with pulmonary embolus and three

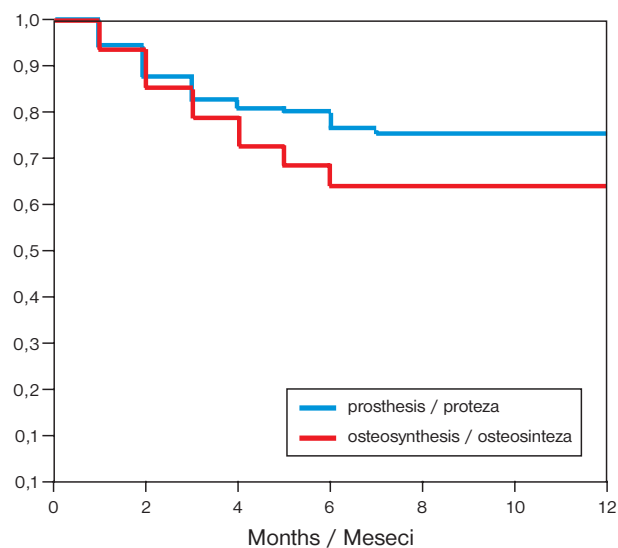


Figure 1. Cumulative survivability of elderly patients with femoral neck fracture by treatment approach.

Sl. 1. Kumulativno preživetje starostnikov z zlomom vratu stegenice glede na metodo zdravljenja.

cases of complications in surgical wound were reported. Four patients (8%) died at the hospital: two due to stomach ulcer haemorrhage, one due to heart failure and one due to respiration failure. All these patients who died were pre-surgically assessed as 3 or 4 according to the ASA. Upon the discharge from the hospital 18 patients (37.5%) had a full walking ability.

One year after the fracture 43 patients (89.6%) were analysed. In 16 patients (33.5%) fracture healing complications were reported (pseudoarthrosis, avascular necrosis of femoral neck). In 8 patients (16.7%) a total endoprosthesis was used due to healing fracture complications. A good treatment outcome was reported in nineteen (44%) elderly patients with femoral neck fracture whose fracture was managed with osteosynthesis.

Group B (prostheses) comprised 81 patients. The average duration of hospitalisation was 17.8 days. Complications occurred in 14 patients (17.3%): four cases of pneumonia, one heart failure and one respiration failure, one multiple organ failure, four deep venous thromboses with pulmonary embolus, and in one patient complications in surgical wound occurred. The dislocation of prosthesis occurred in two patients (2.5%). The mortality rate at the hospital was 7.5%. One patient died due to a pulmonary embolus, two due to respiration failure and one due to a multiple organ failure. All the patients who died, except one, were scored 4 prior to surgery according to the ASA.

One year after the injury, 68 patients (89.5%) were analysed. No re-operation interventions were required. A good treatment outcome was reported in 45 patients (66%).

A cumulative one-year survivability rate was 64.6% in femoral neck fracture patients treated with osteosynthesis while in patients with prosthesis the rate was 75.7% (Figure 1). The difference was not statistically typical (log rank test, $p = 0.20$).

Table 1 shows the results of the multivariate analysis aimed at assessing the parameters impacting a good treatment outcome. The pre-fracture medical condition (3.88 odds ratio), treatment approach (0.33 odds ratio) and clinical rehabilitation efficiency (0.07 odds ratio) had a statistically significant impact on the functional one-year post-fracture result.

Table 1. Impact on rehabilitation of elderly patients treated for dislocated femoral neck fractures after one year – results of multivariate analysis.

Razpr. 1. Vpliv na preživetje starostnikov, zdravljenih zaradi dislociranega zloma vratu stegenice po enem letu – rezultati multivariantne analize.

	B	Wald	DF	SIG (p)	Odds ratio	95% confidence interval	
	B	Wald	DF	SIG (p)	Odds ratio	95% interval zaupanja	
Age Starost	-0.23	0.14	1	0.71	0.79	0.23	2.68
Medical condition ASA lestvica	1.36	5.70	1	0.017	3.88	1.27	11.80
Mobility Mobilnost	-0.16	0.06	1	0.80	0.85	0.24	3.03
Prosthesis Proteza	-1.11	5.68	1	0.017	0.33	0.13	0.82
Discharge Odpust	-2.69	14.68	1	0.0001	0.07	0.02	0.27
Constant Konstanta	1.72	6.89	1	0.087			

Table 2 shows the results of the multivariate analysis aimed at assessing the parameters impacting a one-year post-fracture survivability. The age of the patients (0.30 odds ratio) and hospital rehabilitation efficiency (2.89 odds ratio) had a significant statistical impact on the post-fracture survivability.

Table 2. Impact on survivability of elderly patients treated for dislocated femoral neck fractures one year after the fracture – results of multivariate analysis.

Razpr. 2. Vpliv na preživetje starostnikov, zdravljenih zaradi dislociranega zloma vratu stegenice po enem letu – rezultati multivariantne analize.

	B	Wald	DF	SIG (p)	Odds ratio	95% confidence interval	
	B	Wald	DF	SIG (p)	Odds ratio	95% interval zaupanja	
Age Starost	-1.18	4.64	1	0.03	0.30	0.12	0.76
Medical condition ASA lestvica	-0.35	1.64	1	0.20	0.71	0.45	1.10
Mobility Mobilnost	0.35	1.26	1	0.26	1.42	0.85	2.37
Prosthesis Proteza	0.29	1.52	1	0.22	1.33	0.90	1.96
Discharge Odpust	1.06	6.67	1	0.01	2.89	1.47	5.70
Constant Konstanta	-1.94	10.08	1	0.0015			

Discussion

The aim of the treatment of femoral neck fracture in elderly patients is early mobilisation and immediate weight bearing of surgically treated leg. This allows the patients an early return to their community.^{2,3} The surgeons who prefer osteosynthesis state the preservation of the joint as their main reason for the treatment choice. If the fracture is healed the function of the joint is the best.^{11,12} The fact that there is a significant rate of fracture healing disturbances (up to 35 % of pseudoarthroses and secondary necroses of femoral neck) and that a reoperation is required in 15 % of the cases is well supported in the literature.^{2,13,14} By examining 3000 hip fracture elderly patients Palmer found a high level of morbidity and high reoperation expenses.¹⁵ The advantage of femoral neck fracture care through cemented bipolar endoprosthesis lies in that an elderly patient can immediately apply full weight bearing on the leg and that there are few reoperations required (0.4–4 %).⁷ The authors reported two cases of dislocation of prosthesis (2.5 %) and both were successfully treated without any additional surgical intervention on the hip. Given the high post-hip fracture mortality rate in elderly (up to 40 % during the post-fracture year) and the prosthesis life span of 12 to 15 years, the number of late surgical interventions is low.²

Van Vugt compared 43 elderly with femoral neck fracture in a randomised study by the treatment method. Among the elderly treated with osteosynthesis or prosthesis no difference was reported in the mortality rate, complications at the hospital and the number of reoperations.¹⁶ Conversely, in a study, comprising 367 femoral neck fracture patients 8 years post fracture, Hudson found a significant difference in the survivability rate, which was most obvious in the 65 to 80-year age group.⁴ The results of the analysis conducted at the SUB Celje showed a better one-year survivability rate in elderly patients treated with prosthesis (11.1 % difference), though this difference was not statistically typical. During the hospital treatment there were no differences in the number of complications and the mortality rate of the patients. The age of the patients and rehabilitation efficiency had a statistically significant impact on one-year survivability, as proved by the findings of other authors.^{2,17}

The goal of the elderly hip fracture rehabilitation is to achieve a functional independence.² Through a multivariate analysis the authors examined the parameters, which had an impact on functional independence after the first year post fracture. According to the authors, rehabilitation in the acute phase of the treatment is key to success. An elderly patient who manages to achieve foot-flat weight bearing by the end of the hospital treatment has 14.3 times better chances to regain full walking ability after one year and 2.86 times better survivability chances first year after the fracture than an elderly patient who stays in bed or needs additional assistance in walking. Koval found that the rehabilitation was more efficient in the first post-fracture months, as proved by the po-

stoperative rehabilitation programme.^{3,17} High rehabilitation programme expenses raise doubts about their efficiency. Characteristics should be identified of the elderly patients who benefit most from intensive rehabilitation.¹⁷

The use of a prosthesis allowed for a more successful rehabilitation of post femoral neck fracture in elderly patients. This is confirmed also by the views of numerous authors who support the primary care of femoral neck fractures in elderly with a cemented partial endoprosthesis.^{2,4,7}

This study proves that an intensive rehabilitation in the first months after the fracture is urgent for a successful treatment of elderly with femoral neck fracture. The use of a cemented partial endoprosthesis allows for an immediate verticalisation and weight bearing applied on the injured leg. There is no need for early second surgical interventions to interfere in the vulnerable early rehabilitation. The authors claim that a primary cemented bipolar prosthesis is the treatment choice for elderly with dislocated femoral neck fracture.

References

1. Anon. Statistical Yearbook of the Republic of Slovenia. Ljubljana: Statistični urad; 1997.
2. Beck A, Ruter A. Schenkelhalsfrakturen – Diagnostik und therapeutisches Vorgehen. Unfallchirurg 1998; 101: 634–48.
3. Koval KJ, Skovron ML, Aharonoff GB, Zuckerman JD. Predictors of functional recovery after hip fracture in the elderly. Clin Orthop 1998; 348: 22–8.
4. Hudson JI, Kenzora JE, Hebel JR, Gardner JF, Scherlis L, Epstein RS, Magaziner JS. Eight-year outcome associated with clinical options in the management of femoral neck fractures. Clin Orthop 1998; 348: 59–66.
5. Chua D, Jaglal SB, Schatzker J. An orthopedic surgeon survey on the treatment of displaced femoral neck fractures: opposing views. Canadian Journal of Surgery 1997;40: 271–7.
6. Swiontkowski MF. Intracapsular hip fractures. In: Browner BD, Jupiter JB, Levine AM, Trafton PG, eds. Skeletal trauma. Philadelphia: Saunders; 1992. p. 1369–442.
7. McGann WA. Surgical approaches. In: Callaghan JJ, Rosenberg AG, Rubash HE, eds. The adult hip. Lipnicot Raven Publishers; 1997.
8. Camporesi EM, Greeley WJ, Lumb PD, Watkins WD. Anesthesia. In: Sabiston DC, ed. *Textbook of Surgery*. Philadelphia: Saunders; 1991. p. 156.
9. Mathews DE, Farewell VT. Using and understanding medical statistics. Basel: Krager; 1985.
10. Glantz SA, Slinker BK. Primer of applied regression and analysis of variance. New York: McGraw Hill; 1990.
11. Berglund-Roden M, Swierstra BA, Wingstrand H, Thorngren K. Prospective comparison of hip fracture treatment. 856 cases followed for 4 months in The Netherlands and Sweden. Acta Orthop Scand 1994; 65: 287–94.
12. Robinson CM, Saran D, Annan IH. Intracapsular hip fractures. Results of management adopting a treatment protocol. Clin Orthop 1994; 302: 83–91.
13. Chua D, Jaglal SB, Schatzker J. Predictors of early failure of fixation in the treatment of displaced subcapital hip fractures. J Orthop Trauma 1998; 12: 230–4.
14. Elmeron S, Sjostedt A, Zetterberg C. Fixation of femoral neck fracture. A randomized 2 year follow-up study of hook pins and sliding screw plate in 222 patients. Acta Orthop Scand 1995; 66: 507–10.
15. Palmer SJ, Parker MJ, Hollingworth W. The cost and implications of reoperation after surgery for fracture of the hip. J Bone Joint Surg 2000; 82A: 864.

-
16. Van Vugt AB, Oosterwijk WM, Goris RJ. Osteosynthesis versus endoprosthesis in the treatment of unstable intracapsular hip fractures in the elderly. A randomised clinical trial. Arch Orthop Trauma Surg 1993; 113: 39-45.
 17. Michele JP, Hoffmeyer P, Klopfenstein C, Bruchez M. Prognosis and functional recovery 1 year after hip fracture: Typical patient profiles through cluster analysis. J Gerontol 2000; 55A: 508-17.

Arrived 2006-12-12, accepted 2007-01-11
