Protein Depletion in Thai Patients with Hip Fractures

Werasak Sutipornpalangkul PhD, MD*,
Talabporn Harnroongroj PhD**

** Department of Orthopaedic Surgery, Faculty of Medicine, Siriraj Hospital, Mahidol University, Bangkok*
*** Department of Tropical Nutrition and Food Science, Faculty of Tropical Medicine, Mahidol University, Bangkok*

Objective: *Study the prevalence of protein depletion and determine the effect of protein depletion on post-operative complications.*
Material and Method: *A retrospective study was performed in 255 Thai elderly patients who had been admitted to Siriraj Hospital because of a fracture of the hip. The level of albumin was the parameter used to determine the degree of protein depletion. The effects of protein depletion that were examined were the length of hospital stay and the development of complications.*
Results: *Ninety-seven patients (44.5%) in the study group were in a protein-depleted state during the period of hospitalization. The patients who were protein-depleted had a higher prevalence of complications and tended to stay in the hospital longer, compared with the nonprotein-depleted patients.*
Conclusion: *Thai elderly patients who sustain the trauma of a fracture of the hip should be managed appropriately for the intake of nutrients during the hospitalized period to improve their health status.*

Keywords: *Protein depletion, Hip fracture, Complications*

J Med Assoc Thai 2007; 90 (11): 2332-7
Full text. e-Journal: *http://www.medassocthai.org/journal*

About 2% of Thai women suffer from osteoporosis fractures each year[1]. Hip fracture incidence of 7.05 per 100,000 populations was found. Hip fracture was shown to increase steeply with age[2]. The mortality rate during hospitalization was 2.1%. The 3-, 6-, and 12-month survival rates after hip fractures were 91%, 88%, and 83%, respectively[3]. Length of stay in the orthopedic ward averages between 2 and 3 weeks, and overall hospital stay may average as much as 5 weeks. This leads to a cost of operation and hospital care of around 12,000 baht per case[2]. The long-term cost of complex home and institutional care for those individuals who make a poor recovery is very high. The reasons for poor recovery are complex, but poor nutrition is an important factors[4,5].

It has been known for a long time that hip fracture patients frequently have an impaired nutritional status in many studies[6-10]. In addition, malnutrition is recognized as a risk factor for postoperative complications and prolonged stay in the hospital in these patients[6,11-13]. However, few studies have specifically addressed the nutritional status and the effect of nutrition status on Thai elderly patients who have a fracture of the hip[14,15].

This retrospective study was performed to document the nutritional status of elderly patients who had a fracture of the hip, and to ascertain the effect of this factor on the development of complications in the postoperative period.

Correspondence to : Sutipornpalangkul W, Department of Orthopaedic, Faculty of Medicine, Siriraj Hospital, Bangkok 10700, Thailand. Mobile: 081-751-2428, Phone: 0-2419-7965, E-mail: tewsv@mahidol.ac.th

Material and Method

Participants

The authors performed a retrospective study of patients in Siriraj Hospital over 50 years old with hip fractures caused by minimal injury between January 2005 and March 2006. Patients with pathological fractures, non-osteoporotic osteopathies, or renal disease were not included.

Protein depletion assessments

Nutritional status can be determined by 1) anthropometric measurements (height, weight, triceps

skin fold thickness, and arm muscle circumference), 2) measurement of serum proteins or cell types (lymphocytes), and 3) antibody reaction to certain antigens in skin testing[16,17]. Markers for protein depletion such as skin antigen testing, nitrogen balance, prealbumin levels, or transferrin are costly and time-consuming markers. Although these tests are sensitive indicators of malnutrition, they are not normally performed and thus cannot be used to routinely assess the nutritional status of patients[18-20]. Therefore, the present study was performed to determine protein depletion on patients using cost-effective clinical parameter. The level of serum albumin can easily be obtained from a routine liver function test (LFT). Protein depletion was identified by an albumin level of less than 3.5 g/dL.

Effect of protein depletion

The effect of nutritional status was determined by the length of stay in hospital and the development of postoperative complications. The postoperative complications that were specifically sought included myocardial infarction, cardiac arrhythmia, pneumonia, pulmonary embolism, decubitus ulcer, urinary tract infection, infected prosthesis, and septicemia.

Statistical analysis

Statistical analysis was performed using Stat View for windows version 5. Descriptive statistics were calculated and contingency tables were produced. Chi-Square tests were performed on categorical variables. Unpaired t-test was performed as appropriate. Statistically significant differences was reported when p-value less than 0.05.

Results

Two hundred and twenty-five patients were enrolled in the present study. One hundred and four patients had intertrochanteric fractures, and 151 patients sustained fracture neck of femurs. The average age was 77 years for the intertrochanteric fracture patients and 75 years for the fracture neck of femur patients. There were no statistical differences with regard to the age, sex distribution between intertrochanteric fractures, and fracture neck of femur groups (Table 1).

The average serum albumin level was 3.37 g/dL for the intertrochanteric patients and 3.43 g/dL for fracture neck of femur patients. There were no statistical differences with regard to the serum albumin level between these groups (Table 2).

The criteria for protein depletion were derived from those of Jensen et al[21]. According to their serum albumin levels, ninety-seven patients were classified as protein-depletion during hospitalization. Thus, the incidence of protein depletion was 44.5% in Thai elderly patients who had hip fractures. The incidence of protein depletion was 52.8% for intertrochanteric

Table 1. Age and sex distribution

	Intertrochanteric fracture	Fracture neck of femur	Hip fracture
Number of patients	104	151	255
Age (years): Mean ± SD	77.7 ± 8.1	75.8 ± 8.8	75.8 ± 8.8
Sex			
Male	31 (29.8%)	33 (21.8%)	64 (25.1%)
Female	73 (70.2%)	118 (78.2%)	191 (74.9%)

No statistical significance in these data

Table 2. Nutritional status, according to fracture type

	Intertrochanteric fractures	Fracture neck of femur	Hip fracture
Number of patients	89	129	218
Serum albumin (g/dL): Mean ± SD	3.37 ± 0.37	3.43 ± 0.49	3.41 ± 0.45
Nutrition status			
Normal	42 (42.2%)	79 (61.2%)	121 (55.5%)
Malnutrition	47 (52.8%)*	50 (38.8%)*	97 (44.5%)

* $p < 0.05$

fractures and 38.8% for fracture neck of femur patients. There were statistical differences with regard to incidence of protein depletion between the intertrochanteric fracture and fracture neck of femur groups ($p < 0.05$) (Table 2).

The patients stayed in the hospital for an average of twenty days (range, one to ninety days). Ninety-seven protein-depleted patients were hospitalized for a mean of twenty-five days and 121 non-protein-depleted patients, for a mean of eighteen days. It was significantly prolonged for the protein-depleted group ($p < 0.01$) (Fig. 1).

There were 39 postoperative complications. In this period, post-operative mortality was 0.8% (two patients), which is lower than that reported by other authors[3]. Five patients developed a myocardial infarction, 23 had infection, eleven had pneumonia, seven had decubitus ulcer, and four had vascular occlusion.

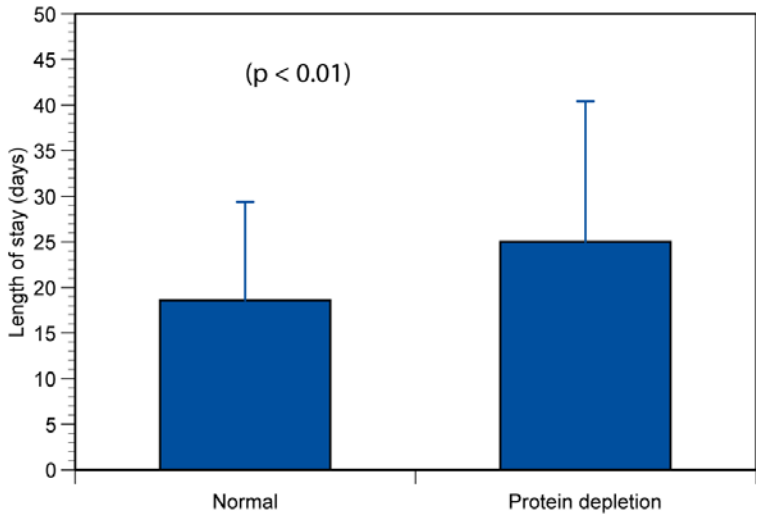

Fig. 1 The length of stay in hospital and the protein status of the patients
Data were mean and standard deviation

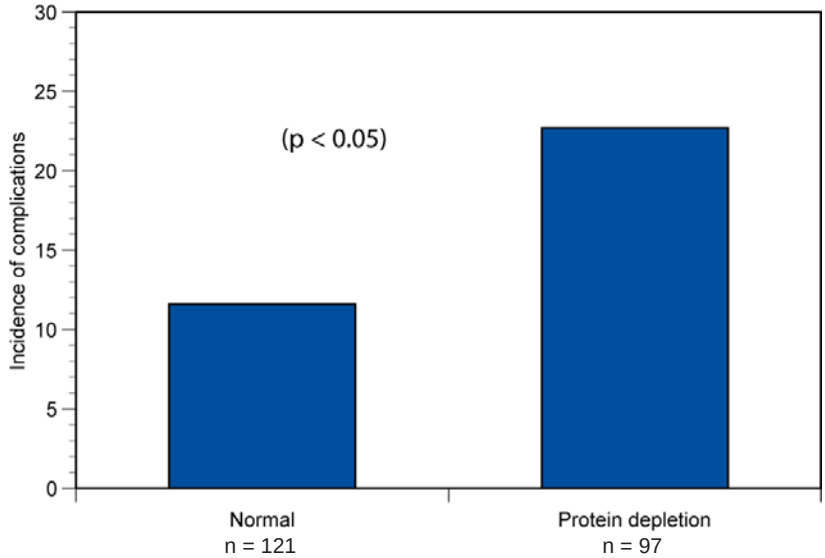

Fig. 2 The prevalence of complications and the protein status of the patients

The complication rate was significantly higher in protein-depleted patients (22.7%) compared with non-protein-depleted patients (11.6%; $p < 0.05$) (Fig. 2).

Discussion

The present study found that malnutrition at hospital admission was present in 44.5% of patients by albumin level. This high rate of malnutrition after hip fracture is consistent with that reported by Patterson et al[6], who found that 58% of hip fracture patients were in a protein-depleted condition during the first week of hospitalization. Jensen et al[21] analyzed a series of 129 consecutive patients admitted to an orthopedic service and found an average incidence of malnutrition of 42.4%. By their criteria, 28.6% of patients undergoing elective total hip replacement were nutritionally depleted, as were 58.6% of patients with multiple trauma and patients with femur fractures.

The measures of visceral protein stores indicated that 44.5% of patients had protein depletion. These patients had more complications, and tended to stay in the hospital longer. Albumin is a visceral protein, synthesized in the liver, and it has a longer half-life than the remaining visceral proteins: transferrin, prealbumin, and retinol-binding protein[18,22]. Hypoalbuminemia is an accepted indicator of global protein depletion[18,20,22,23]. Albumin has several recognized physiological roles in wound healing that are adversely affected in a hypoalbuminic state. It serves as a protector of intravascular oncotic pressure, an amino acid transporter from the liver, an amino acid donor for extrahepatic tissue synthesis, and a transport mechanism for zinc (important in collagen cross-linking) and fatty acids (important peripheral substrate)[24]. Decreased levels of albumin have been demonstrated to be associated with an increased length of hospital stay, impaired wound healing, increased rates of wound infection, pneumonia and sepsis, and an increased incidence of postoperative complications[6,12,21,23,25-31]. Weinsier et al found in a population of general medical patients that those who had lower albumin levels were more likely to have increased lengths of hospitalization[32]. Dreblow et al reached the same conclusion based on a group of orthopedic patients[33]. Mandelbaum et al reported a 40% complication rate after two-stage spinal reconstruction in patients whose the albumin level was < 3.5 grams/deciliter[34].

Conclusion

Ninety-seven patients (44.5%) in the study group were in a protein-depleted state during the period of hospitalization. The patients who were protein-depleted had a higher prevalence of complications and tended to stay in the hospital longer, compared with the nonprotein-depleted patients.

Therefore, Thai elderly patients who sustain the trauma of a fracture of the hip should be managed appropriately for the intake of nutrients during the hospitalized period to improve their health status.

References

1. Pongchaiyakul C, Nguyen ND, Eisman JA, Nguyen TV. Clinical risk indices, prediction of osteoporosis, and prevention of fractures: diagnostic consequences and costs. Osteoporos Int 2005; 16: 1444-50.
2. Suriyawongpaisal P, Siriwongpairat P, Loahachareonsombat W, Angsachon T, Kumpoo U, Sujaritputtangkul S, et al. A multicenter study on hip fractures in Thailand. J Med Assoc Thai 1994; 77: 488-95.
3. Chariyalertsak S, Suriyawongpisal P, Thakkinstain A. Mortality after hip fractures in Thailand. Int Orthop 2001; 25: 294-7.
4. Avenell A, Handoll HH. Nutritional supplementation for hip fracture aftercare in older people. Cochrane Database Syst Rev 2005; CD001880.
5. Avenell A, Handoll HH. Nutritional supplementation for hip fracture aftercare in older people. Cochrane Database Syst Rev 2006; CD001880.
6. Patterson BM, Cornell CN, Carbone B, Levine B, Chapman D. Protein depletion and metabolic stress in elderly patients who have a fracture of the hip. J Bone Joint Surg Am 1992; 74: 251-60.
7. Rico H, Relea P, Crespo R, Revilla M, Villa LF, Arribas I, et al. Biochemical markers of nutrition in type-I and type-II osteoporosis. J Bone Joint Surg Br 1995; 77: 148-51.
8. Bonjour JP, Schurch MA, Rizzoli R. Nutritional aspects of hip fractures. Bone 1996; 18: 139S-44S.
9. Huang Z, Himes JH, McGovern PG. Nutrition and subsequent hip fracture risk among a national cohort of white women. Am J Epidemiol 1996; 144: 124-34.
10. Mussolino ME, Looker AC, Madans JH, Langlois JA, Orwoll ES. Risk factors for hip fracture in white men: the NHANES I Epidemiologic Follow-up Study. J Bone Miner Res 1998; 13: 918-24.
11. Delmi M, Rapin CH, Bengoa JM, Delmas PD, Vasey H, Bonjour JP. Dietary supplementation in elderly patients with fractured neck of the femur. Lancet 1990; 335: 1013-6.

12. Foster MR, Heppenstall RB, Friedenberg ZB, Hozack WJ. A prospective assessment of nutritional status and complications in patients with fractures of the hip. J Orthop Trauma 1990; 4: 49-57.
13. Koval KJ, Maurer SG, Su ET, Aharonoff GB, Zuckerman JD. The effects of nutritional status on outcome after hip fracture. J Orthop Trauma 1999; 13: 164-9.
14. Jitapunkul S, Yuktanandana P. Consequences of hip fracture among Thai women aged 50 years and over: a prospective study. J Med Assoc Thai 2000; 83: 1447-51.
15. Jitapunkul S, Yuktananandana P, Parkpian V. Risk factors of hip fracture among Thai female patients. J Med Assoc Thai 2001; 84: 1576-81.
16. Omran ML, Salem P. Diagnosing undernutrition. Clin Geriatr Med 2002; 18: 719-36.
17. Omran ML, Morley JE. Assessment of protein energy malnutrition in older persons, Part II: Laboratory evaluation. Nutrition 2000; 16: 131-40.
18. Fletcher JP, Little JM, Guest PK. A comparison of serum transferrin and serum prealbumin as nutritional parameters. JPEN J Parenter Enteral Nutr 1987; 11: 144-7.
19. Forse RA, Rompre C, Crosilla P, Tuitt D, Rhode B, Shizgal HM. Reliability of the total lymphocyte count as a parameter of nutrition. Can J Surg 1985; 28: 216-9.
20. Ingenbleek Y, De Visscher M, De Nayer P. Measurement of prealbumin as index of protein-calorie malnutrition. Lancet 1972; 2: 106-9.
21. Jensen JE, Jensen TG, Smith TK, Johnston DA, Dudrick SJ. Nutrition in orthopaedic surgery. J Bone Joint Surg Am 1982; 64: 1263-72.
22. Shetty PS, Watrasiewicz KE, Jung RT, James WP. Rapid-turnover transport proteins: an index of subclinical protein-energy malnutrition. Lancet 1979; 2: 230-2.
23. Bistrian BR, Blackburn GL, Hallowell E, Heddle R. Protein status of general surgical patients. JAMA 1974; 230: 858-60.
24. Powanda MC, Moyer ED. Plasma proteins and wound healing. Surg Gynecol Obstet 1981; 153: 749-55.
25. Bastow MD, Rawlings J, Allison SP. Undernutrition, hypothermia, and injury in elderly women with fractured femur: an injury response to altered metabolism? Lancet 1983; 1: 143-6.
26. Dickhaut SC, DeLee JC, Page CP. Nutritional status: importance in predicting wound-healing after amputation. J Bone Joint Surg Am 1984; 66: 71-5.
27. Kay SP, Moreland JR, Schmitter E. Nutritional status and wound healing in lower extremity amputations. Clin Orthop Relat Res 1987: 253-6.
28. Mullen JL, Gertner MH, Buzby GP, Goodhart GL, Rosato EF. Implications of malnutrition in the surgical patient. Arch Surg 1979; 114: 121-5.
29. Mullen JL, Buzby GP, Matthews DC, Smale BF, Rosato EF. Reduction of operative morbidity and mortality by combined preoperative and postoperative nutritional support. Ann Surg 1980; 192: 604-13.
30. Puskarich CL, Nelson CL, Nusbickel FR, Stroope HF. The use of two nutritional indicators in identifying long bone fracture patients who do and do not develop infections. J Orthop Res 1990; 8: 799-803.
31. Reinhardt GF, Myscofski JW, Wilkens DB, Dobrin PB, Mangan JE Jr, Stannard RT. Incidence and mortality of hypoalbuminemic patients in hospitalized veterans. JPEN J Parenter Enteral Nutr 1980; 4: 357-9.
32. Weinsier RL, Hunker EM, Krumdieck CL, Butterworth CE Jr. Hospital malnutrition. A prospective evaluation of general medical patients during the course of hospitalization. Am J Clin Nutr 1979; 32: 418-26.
33. Dreblow DM, Anderson CF, Moxness K. Nutritional assessment of orthopedic patients. Mayo Clin Proc 1981; 56: 51-4.
34. Mandelbaum BR, Tolo VT, McAfee PC, Burest P. Nutritional deficiencies after staged anterior and posterior spinal reconstructive surgery. Clin Orthop Relat Res 1988: 5-11.

ภาวะโปรตีนต่ำในผู้ป่วยไทยที่มีภาวะกระดูกสะโพกหัก

วีระศักดิ์ สุทธิพรพลางกูร, ตลับพร หาญรุ่งโรจน์

การศึกษาแบบย้อนหลังนี้ทำขึ้นเพื่อศึกษาหาความชุกของภาวะโปรตีนต่ำ และผลของภาวะโปรตีนต่ำต่อภาวะแทรกซ้อนหลังการผ่าตัดในผู้ป่วยไทยจำนวน 255 คนที่เข้ารับการรักษาที่โรงพยาบาลศิริราชเพราะกระดูกสะโพกหัก มาตรวัดที่ใช้ในการบ่งชี้ภาวะโปรตีนต่ำคือ ระดับแอลบูมินในซีรัม ผลข้างเคียงของการมีภาวะโปรตีนต่ำที่ทำการศึกษา คือ ระยะเวลาในการอยู่โรงพยาบาล และภาวะแทรกซ้อนที่เกิดขึ้นหลังการผ่าตัด

ผลการศึกษาสนับสนุนสมมติฐานของผู้รายงาน ผู้ป่วยจำนวน 97 คน (44.5%) ในกลุ่มของการศึกษานี้อยู่ในภาวะโปรตีนต่ำในช่วงเวลาของการอยู่โรงพยาบาล ผู้ป่วยที่อยู่ในภาวะโปรตีนต่ำมีความชุกของการเกิดภาวะแทรกซ้อนสูงกว่า และระยะเวลาในการอยู่โรงพยาบาลนานกว่าเมื่อเปรียบเทียบกับกลุ่มผู้ป่วยที่ไม่มีภาวะโปรตีนต่ำ

ดังนั้นกลุ่มผู้ป่วยไทยที่ประสบอุบัติเหตุแล้วมีกระดูกสะโพกหัก ควรได้รับการดูแลรักษาที่เหมาะสมในด้านภาวะโภชนาการในระหว่างรับการรักษาที่โรงพยาบาล เพื่อภาวะสุขภาพที่ดีขึ้น