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Analysis of risk factors affecting mortality in elderly patients (aged over 65 years) operated on for hip fractures

Kalça kırığı nedeniyle ameliyat edilen 65 yaş üstü hastalarda mortaliteye etki eden risk faktörlerinin değerlendirilmesi

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Amaç: Bu çalışmada kalça kırığı nedeniyle ameliyat edilen 65 yaş üstü hastalarda mortalite oranları ile ameliyat öncesi medikal durum ve yaşamsal faktörler arasındaki ilişki değerlendirildi.

Çalışma planı: Çalışmada, kalça kırığı nedeniyle ameliyat edilen ve 36 aylık takip verileri bulunan 92 hasta (56 kadın, 36 erkek) değerlendirildi. Kadın hastaların yaş ortalaması 76 (dağılım 65-96), erkek hastaların yaş ortalaması 74 (dağılım 65-92) idi. Kırıklar 54 hastada (%58.7) intertrokanterik bölgede, 38 hastada (%41.3) femur boynunda idi. Tüm hastalar "Şişli Etfal" risk faktörleri skorlamasına göre düşük (n=23, %25), orta (n=45, %48.9) ve yüksek (n=24, %26.1) riskli olarak gruplara ayrıldı. Her bir risk grubunda cinsiyet, kırık öncesi yürüme durumu, bilişsel fonksiyonlar ve ameliyata kadar geçen sürenin mortalite ile ilişkisi değerlendirildi.

Sonuçlar: Bir yıllık ölüm oranları, düşük risk grubunda %6.9, orta risk grubunda %31.4, yüksek risk grubunda ise %80 olarak hesaplandı. Skorlama sonuçları ile mortalite oranları anlamlı ilişki gösterdi ($r=0.664$; $p<0.05$). Kadın hastaların 34'ünün (%60.7), erkek hastaların ise 18'inin (%50) 36 ay sonunda öldüğü belirlendi. Cinsiyetin, bilişsel fonksiyonların ve ameliyata kadar geçen sürenin mortalite oranları üzerine anlamlı etkisi görülmedi ($p>0.05$). Yürüteç kullanarak yürüyebilen hastalarda ilk üç ay içindeki ölüm oranı, bir destekle veya tamamen bağımsız yürüyebilen hastalara göre anlamlı derecede yüksek idi ($p=0.037$).

Çıkarımlar: Kalça kırığı ameliyatlarından sonra mortalite oranlarının tahmininde, tüm risk faktörlerini içeren ayrıntılı bir skorlama sisteminin kullanılması tedavinin planlanması yönünden uygun olacaktır.

Anahtar sözcükler: Yaşlılık; komorbidite; kalça kırığı/mortalite; osteoporoz/komplikasyon; prognoz; yaşam kalitesi; risk faktörü.

Objectives: We analyzed the relationship between mortality rates and preoperative medical conditions and vital factors in elderly patients (aged over 65 years) operated on for hip fractures.

Methods: The study included 92 patients (56 females, 36 males) who were operated on for hip fractures and had follow-up data up to 36 months. The mean age was 76 years (range 65 to 96 years) for women, and 74 years (range 65 to 92 years) for men. The fractures were intertrochanteric in 54 patients (58.7%), and in the femur neck in 38 patients (41.3%). The patients were divided into three risk groups, namely, low (n=23, 25%), moderate (n=45, 48.9%), and high (n=24, 26.1%), according to our institutional Şişli Etfal risk factor assessment scale. Relationships were analyzed between mortality and sex, preinjury ambulation level, cognitive functions, and time to surgery in each risk group.

Results: One-year mortality rates were 6.9%, 31.4%, and 80% in low-, moderate-, and high-risk groups, respectively. The risk scores were significantly correlated with mortality rates ($r=0.664$; $p<0.05$). Thirty-four female patients (60.7%) and 18 male patients (50%) were dead at the end of 36 months. No significant relationship was found between mortality rates and sex, cognitive functions, and time to surgery ($p>0.05$). Mortality within the first three postoperative months among patients who could only ambulate with a walker preoperatively was significantly higher than those who could walk independently or with an aid ($p=0.037$).

Conclusion: A risk assessment system covering all risk factors to estimate postoperative mortality following surgery for hip fractures would be helpful in planning treatment.

Key words: Aged; comorbidity; hip fractures/mortality; osteoporosis/complications; prognosis; quality of life; risk factors.

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An older population raised up in the world in recent years as a result of increased life time. Decrease in physical capacity, common systemic diseases, weakening of reflexes, loose of hearing and defects of vision all cause reduction of functions to be protected from dangers. Decrease in bone density due to aging results in increase at fracture risk.[1-3] Hip fractures are skeletal injuries mostly seen in elderly with high mortality and morbidity rates. In elderly, treated for hip fracture, mean life time becomes shorter when compared with the same age group. Medical condition and other medical problems except hip fracture are the most important factors effecting on mortality rates.[3-6] In this study, we aimed to make a statistical analysis of the relationship between mortality rates with preoperative medical conditions and vital factors in patients over 65 year-old operated for a hip fracture.

Patients and methods

Ninety-two (56 female(60.8%)mean age; 76,4[65-96], 36 male (%39,2) mean age; 74,3 [65-92]))of 152 patients operated for a hip fracture between 1997-1999 were evaluated retrospectively. Fifty-four patients (58.7%) had intertrochanteric hip fracture when 38 patients had collum femoris hip fracture. Patients were taken into study under the light of Şişli Etfal risk factor assessment scale (Table 1) consisting of knowledge about age, daily activity level, osteoporosis, demeans, heart diseases, hypertension, diabetes, vascular occlusion, respiratory diseases, electrocardiographic findings, hemoglobin and protein levels, gastrointestinal diseases, obesity, and presence of cancer routinely recorded for hip fracture patients preoperatively in our clinic. All patients operated with a partial hip prosthesis. Patients were categorized as low, moderate and high risk groups according to the scores. Not only the relationship between mortality and risk groups, specified by the assessment of all pa-

Table 1. Şişli Etfal Research and Training Hospital Risk Scoring System Before Hip Fracture Surgery

Age		Diabetes Mellitus	1
<70	0	Vascular occlusion	1
70-79	1	Lung pathologies	
80-89	2	Asthma	1
>90	3	Infection	1
Daily activity degree before fracture		Chronic Obstructivc Lung Disease	
Free	0	Tumor	1
One crutch	1	Tuberculosis	1
Walker	2	ECG	
Bedridden	3	Normal	0
Osteoporosis (Singh)		Aritmia	1
0-3	0	Infarction sign	2
4-5	1	ST-T changes, AV block	3
6	2	Blood tests	
Dementia (Hagerawa criteria's)		Hb (gr/dl) 11<	1
Normal	0	Hb (gr/dl) 11>	0
Borderline	1	Total protein (<6 gr)	1
Predemantia	2	Total protein (>6 gr)	0
Dementia	3	Gastrointestinal disease	1
Heart Pathologies		Neurologic disease	
MI		Hemiplegia	1
Angina pectoris	1	Parkinson	1
Right heart failure	1	Genitourinary disease	1
Ventricular extrasistol	1	Obesity	1
Cardiac aritmia	1	Cancer	1
Hypertension	1		

Total risk skore : 0-5 – Low risk group; 6-10 – Medial;
11-15 – High; >15 – Very high

Table 2. Mortality rates for male – female

	FM		M	
Month	n	%	n	%
3	12	21.4	5	13.9
6	15	26.8	8	22.2
12	23	41.1	14	38.9
24	33	58.9	16	44.4
36	34	60.7	18	50.0

rameters, but also, the relationship between mortality rates and gender, mobility level before fracture, cognitive functions and time to surgery, were statistically studied one by one.

Results

Twenty-three (25%) patients were in low, 45(48.9%) patients were in moderate and 24 patients (26.1%) were in high risk groups. One year mortality rates were 6.9%, 31.4% and 80% in low-risk group, moderate risk and high risk group respectively. Scoring results and mortality rates were statistically significant ($p<0.05$) and correlated(r: 0.664). It was found that, 60,7% of female and 50% of male died at the end of 36 months(Table 2). High female mortality rates was not found to be statistically significant ($p> 0,05$). When seven(63.6.9%) of 11 patients(11.9%) using walker before fracture, died in the first three months, all of this group died in one-year(Table 3). When compared with independent or one crutch using patients, these results were found to be statistically significant (p:0,037). Hagesawa's criteria were used to make the assessment of cognitive functions. All patients in the group of dementia died in the first year but results were not statistically significant ($p>0.05$)(Table 4). Patients were grouped as 'patient operated between 0-5th. day, 6th.-10th. day, 11th.-15th.day and as patients operated after 16th.day.' Not a statistically significant effectively on mortality rates was detected for the delay to surgery.

Discussion

As a result of improvements in medicine, the mean life time of man gets longer thereby, elderly populations have an increase. According to 2001 data of UNICEF, when life expectance was 56 in 1970, it became 64 by 1999.[8] Stopping aging is impossible genetically. Decrease in physical capacity, common systemic diseases, weakening of reflexes, loose of hearing and defects of vision all cause reduction of functions to be protected from dangers and exposures of simple traumas increase. Additionally, by the decrease in bone density, fracture risk increases with these simple traumas.[2,4]

Hip fractures are skeletal injuries mostly seen in elderly with high mortality and morbidity rates. Many studies, investigating the hip fracture mortality rates and factors effecting on this, take part in literature. Prade et al in a hundred patients study, found one-

Table 3. Affect of ambulation degree before fracture to mortality rates

	Patient (n=92)		3 month mortality		1 year mortality		Survived after 36 months	
	n	%	n	%	n	%	n	%
Ambulation degree before fracture								
Walker	11	12.0	7	63.6	11	100.0	0	0
One crucht	33	35.9	6	18.2	14	42.4	9	27.3
Free	48	52.2	4	8.3	12	25.0	27	56.3
Cognitive functions (Hagesawa Criteria)								
Normal	41	44.6	4	9.8	11	26.8	25	61.0
Border	34	37.0	8	23.5	14	41.2	9	26.5
Predemans	10	10.9	2	20.0	5	50.0	2	20.0
Demans	7	7.6	3	42.9	7	100.0	0	0
Time to operation (day)								
≤5	8	8.7	0	0	3	37.5		
6-10	42	45.7	5	11.9	13	31.0		
11-15	31	33.7	8	25.8	13	41.9		
≥16	11	12.0	4	36.4	6	54.6		

year mortality about 45% in hip fracture patients while it was 1% in control group.[9] Brossa Toruella et al determined 40% mortality rate in study group when 16.5% was found for controls. They found the three year mortality associated with heart failure, neoplasia and dementia (10). Farahmand et al showed a six-year long increase of mortality risk after a hip fracture.[11] 29% one-year mortality rate was found for patients operated for a hip fracture in a study of Mc Leod et al. They found that mortality rates were related with age, gender, medical conditions and living place. Surgery time, type of surgery and anesthesia were found to have minimal effect on mortality rates.[12] Franzo et al determining one-year mortality rate about 25%, stated that, mortality rates increased by aging, male gender and comorbidities.[13] Yearly mortality rate was given 33% in a study of Roche et al.[14] In this study; cardiovascular diseases, plegia, respiratory system diseases, renal failure, diabetes mellitus, rheumatologic diseases, Parkinson disease, presence of cancer, Paget's disease, smoking and enteral steroid use were determined factors of comorbidity and presence of three or more factors was related with high risk of mortality. Cornwall et al showed that only functional level before injury was an independent marker of mortality.[15] Meyer et al stated that mortality rates increased markedly in patients who could not walk alone outside before injury and who have lower scores of mental state tests and two or more chronic diseases.[5] Svensson et al related mortality levels to number of preoperative medical problems. One-year mortality rate for patients without any other health problems was 0% while it was 14% and 24% for patients having one or two and patients having three or four health problems respectively.

The relation between preoperative functional state and medical condition is clear. When compared with independent or one crutch using patients, the patients using walker before fracture had higher mortality rates and results were found to be statistically significant (p:0,037).

Ishida et al declared preoperative general condition, walking capacity and type of fracture and surgery to be the marker of survival rates and stated that dementia level was main predictor of recovery of walking capacity.[17] Beloosesky et al stated that, dementia would not effect the complications and functional benefits in patients who were able to walk before fracture.[18] Huusko et al also did not find a clear difference in mortality rates and hospitalization times between patients with dementia and those who have normal scores of mini mental status tests.

Carpintero et al stated that males had higher mortality rates as a result of poorer nutrition, more comorbidities and more smoking and taking alcohol.[20] Jiang et al found one year mortality 37.5% for males and 28.2% for females.[21] In this study, advanced age, male gender, living in sanitary home and comorbidities are described factors resulting higher mortality rates. Alegre-Lopez et al suggested that, functional failure before fracture, poor mental status, age more than eighty and female gender resulted in higher mortality.[22] We also found higher mortality in females but results were not statistically significant. Kenzora et al found one-year mortality 13% for subcapital fractures and 15% for intertrochanteric fractures. In this study, gender, type of treatment and postoperative ambulation levels were found to be ineffective while associated medical problems and delayed surgery increased mortality rates.[6]

Both Zuckerman et al [23] and Baker et al[24] in their studies, stated that delayed surgery resulted higher mortality. We also found higher mortality rates in patient operated later than five days but results were not statistically significant. Preoperative medical status is very important for high mortality and morbidity rates after hip fracture surgery. Therefore, preoperative conditions of patients must be evaluated carefully. Risk scoring systems are useful not only to predict the postoperative conditions of patients and possible medical complications and prognosis but also to help the surgeon to choose the right surgical technique.[7,25,26]

Immediate multidisciplinary geriatric care reduces hospital mortality and medical complications.[3] ASA scoring is used for prediction of long term mortality.[27] Hamlet et al found three-year mortality 23% in ASA I-II, 39% in ASA II-IV patients and stated that ASA classification was a good predictor for mortality.[28] White et al emphasized that ASA classification was subjective and more suitable scoring systems were needed to predict postoperative mortality rates.[29] In a study of Miller et al, patients were classified by medical history, physical examination, thorax x-ray and blood tests. Mortality rate was 2.5% in group I, 11.9%in group II and 44.1% in group III.

In a risk assessment scale of Kyo et al, gender, age, preoperative daily activity, ECG and EEG findings, Hagesawa's criteria for dementia, hemoglobin and total protein levels and type of fracture were included. They stated that the scale was useful to predict the mortality rates and functional prognosis.[7] In physiologic status score(pss) built up by Rabinson et al, life style, mobility, osteoporosis, dementia and medical parameters were included and treatment type was advised to be chosen according to pss.

Rewising the studies about the mortality rates of hip fracture surgery, it is realized that various of results were reported according to various of parameters. The most common result of all studies is that, preoperative medical condition is the most effective criteria to predict the postoperative mortality rate. The risk assessment scale we used in our study facilitates a comprehensive assessment with its wide content.

Scoring results and mortality rates were statistically significant and correlated(r:0.664). Using such assessment scales will not only help to predict the prognosis but also to choose the appropriate treatment protocols. In order to reduce high mortality rates, hip fracture patients have to be evaluated carefully before surgery by handling all medical problems and they have to be stabilized as soon as possible and then must be operated in the most appropriate fashion due to fracture type and risk status.

References

1. Öztürk İ. Kalça kırıklarında prognozu etkileyen risk faktörleri. Acta Orthop Traumatol Turc 1997;31:374-7.
2. Cummings SR, Kelsey JL, Nevitt MC, O'Down KJ. Epidemiology of osteoporosis and osteoporotic fractures. Epidemiol Rev 1985;7:178-208.
3. Vidan M, Serra JA, Moreno C, Riquelme G, Ortiz J. Efficacy of a comprehensive geriatric intervention in older patients hospitalized for hip fracture: a randomized, controlled trial. J Am Geriatr Soc 2005;53:1476-82.
4. Wehren LE, Magaziner J. Hip fracture: risk factors and outcomes. Curr Osteoporos Rep 2003;1:78-85.
5. Meyer HE, Tverdal A, Falch JA, Pedersen JI. Factors associated with mortality after hip fracture. Osteoporos Int 2000;11:228-32.
6. Kenzora JE, McCarthy RE, Lowell JD, Sledge CB. Hip fracture mortality. Relation to age, treatment, preoperative illness, time of surgery, and complications. Clin Orthop Relat Res 1984;(186):45-56.
7. Kyo T, Takaoka K, Ono K. Femoral neck fracture. Factors related to ambulation and prognosis. Clin Orthop Relat Res 1993;(292):215-22.
8. UNICEF. The State of the World's Children 2001. Internet erişimi: www.unicef.org/sowc01.
9. Pande I, Scott DL, O'Neill TW, Pritchard C, Woolf AD, Davis MJ. Quality of life, morbidity, and mortality after low trauma hip fracture in men. Ann Rheum Dis 2006; 65:87-92.
10. Brossa Torruella A, Tobias Ferrer J, Zorrilla Ribeiro J, Lopez Borras E, Alabart Teixido A, Belmonte Garridof M. Mortality after hip fracture: a three year follow-up study. Med Clin 2005;124:53-4. [Abstract]
11. Farahmand BY, Michaelsson K, Ahlbom A, Ljunghall S, Baron JA; Swedish Hip Fracture Study Group. Survival after hip fracture. Osteoporos Int 2005;16:1583-90.
12. McLeod K, Brodie MP, Fahey PP, Gray RA. Long-term survival of surgically treated hip fracture in an Australian regional hospital. Anaesth Intensive Care 2005;33:749-55.
13. Franzo A, Francescutti C, Simon G. Risk factors correlated with post-operative mortality for hip fracture surgery in the elderly: a population-based approach. Eur J Epidemiol 2005;20:985-91.
14. Roche JJ, Wenn RT, Sahota O, Moran CG. Effect of comorbidities and postoperative complications on mortality after hip fracture in elderly people: prospective observational cohort study. BMJ 2005;331:1374.
15. Cornwall R, Gilbert MS, Koval KJ, Strauss E, Siu AL. Functional outcomes and mortality vary among different types of hip fractures: a function of patient characteristics. Clin Orthop Relat Res 2004;(425):64-71.
16. Svensson O, Stromberg L, Ohlen G, Lindgren U. Prediction of the outcome after hip fracture in elderly patients. J Bone Joint Surg [Br] 1996;78:115-8.
17. Ishida Y, Kawai S, Taguchi T. Factors affecting ambulatory status and survival of patients 90 years and older with hip fractures. Clin Orthop Relat Res 2005;(436):208-15.
18. Beloosesky Y, Grinblat J, Epelboym B, Hendel D. Dementia does not significantly affect complications and functional gain in elderly patients operated on for intracapsular hip fracture. Arch Orthop Trauma Surg 2001;121:257-60.
19. Huusko TM, Karppi P, Avikainen V, Kautiainen H, Sulkava R. Randomised, clinically controlled trial of intensive geriatric rehabilitation in patients with hip fracture: subgroup analysis of patients with dementia. BMJ 2000;321:1107-11.
20. Carpintero P, Lopez P, Leon F, Lluch M, Montero M, Aguilera C. Men with hip fractures have poorer nutritional status and survival than women: a prospective study of 165 patients. Acta Orthop 2005;76:331-5.
21. Jiang HX, Majumdar SR, Dick DA, Moreau M, Raso J, Otto DD, et al. Development and initial validation of a risk score for predicting in-hospital and 1-year mortality in patients with hip fractures. J Bone Miner Res 2005;20:494-500.
22. Alegre-Lopez J, Cordero-Guevara J, Alonso-Valdivielso

JL, Fernandez-Melon J. Factors associated with mortality and functional disability after hip fracture: an inception cohort study. Osteoporos Int 2005;16:729-36.

23. Zuckerman JD, Skovron ML, Koval KJ, Aharonoff G, Frankel VH. Postoperative complications and mortality associated with operative delay in older patients who have a fracture of the hip. J Bone Joint Surg [Am] 1995;77:1551-6.
24. Baker DM. Postoperative complications and mortality associated with operative delay in older patients who have a fracture of the hip. J Bone Joint Surg [Am] 1997;79:470.
25. Robinson CM, Saran D, Annan IH. Intracapsular hip fractures. Results of management adopting a treatment protocol. Clin Orthop Relat Res 1994;(302):83-91.
26. Miller K, Atzenhofer K, Gerber G, Reichel M. Risk prediction in operatively treated fractures of the hip. Clin Orthop Relat Res 1993;(293):148-52.
27. Michel JP, Klopfenstein C, Hoffmeyer P, Stern R, Grab B. Hip fracture surgery: is the pre-operative American Society of Anesthesiologists (ASA) score a predictor of functional outcome? Aging Clin Exp Res 2002;14:389-94.
28. Hamlet WP, Lieberman JR, Freedman EL, Dorey FJ, Fletcher A, Johnson EE. Influence of health status and the timing of surgery on mortality in hip fracture patients. Am J Orthop 1997;26:621-7.
29. White BL, Fisher WD, Laurin CA. Rate of mortality for elderly patients after fracture of the hip in the 1980's. J Bone Joint Surg [Am] 1987;69:1335-40.