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Hip Fracture and Geriatric Patients : Comparisons among Hip Fracture Patients, Elderly Patients and Total Patients

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Abstract

Background

Charts of hip fracture patients undergoing surgical repair in 1993-1995 were examined retrospectively to determine if their characteristics were distinct from other operative patients. Elderly patients groups were made to determine age effects and to determine characteristics of hip fracture patients besides age effects.

Methods

Comparisons were made of preoperative blood counts, biochemical data and co-existing diseases between hip fracture cases (HF: n = 87), all surgical cases (T: n = 2637) and surgical patients aged 70 years or more (70-Y: n = 586).

Results

Red cell count (RBC), hemoglobin concentration (Hb), hematocrit (Hct) and platelet count (Plt) were higher in the T group than in the 70-Y group ($P < 0.001$) and the HF group ($P < 0.01, 0.01, 0.001, 0.01$). RBC and Hb were higher in the 70-Y group than in the HF group ($P < 0.01, 0.05$). White blood cell count (WBC) was higher in the HF group than in the T group ($P < 0.001$) and the 70-Y group ($P < 0.01$). Plt was greater in women than in men in the T group ($P < 0.01$). BUN and creatinine was greater in the 70-Y group than in the T group ($P < 0.001, 0.05$). Fasting blood glucose levels (FBS) were higher in the HF group than in the T group ($P < 0.001$) and the 70-Y group ($P < 0.05$). PaO_2 was less in the HF group than in the other two groups ($P < 0.001$). Prevalence of brain diseases was higher in theHF group than in the 70-Y group ($P < 0.01$).

Conclusion

Hip fracture patients have a great tendency to anemia. It may be caused by anemia in elderly patients followed by bleeding due to the fracture. There was the tendency for hypoxia in hip fracture patients due to bed rest. Co-existing of neurological deficits might facilitate occurrence of hip fracture.

Key Words

Hip fracture, Osteoporosis, Anemia, Geriatrics

Osteoporosis is becoming a more frequent problem as the population of senior people increases. Hip fracture may occur after a relatively minor injury such as falls because of osteoporosis. Osteoporosis may be related to diet, exercise, age or genetic factors [1]. However, precise mechanisms remain unknown. Native Japanese have smaller bone mass and greater incidence of vertebral fracture than Japanese Americans and Caucasians. However, there is no difference in incidence of hip fracture between native Japanese and Japanese Americans. Native Japanese and Japanese Americans have smaller incidence of hip fracture than Caucasians [2]. Incidence of vertebral and hip fractures has an apparent relationship to bone mass [3,4]. Other factors such as life style and shape of the femoral bone may explain the difference in incidence of hip fractures between Japanese and Caucasians [5]. A relatively high fracture rate in lean females may be caused by lesser gravitational effects on bones and

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less estrogen produced in fat tissue. Bone mass is commonly lower in women than in men.

Surgery for hip fracture is a frequent procedure. We analyzed preoperative data of Japanese hip fracture patients in Kochi Red Cross Hospital to determine if their characteristics are different from other surgical patients.

Subjects and Methods

We examined retrospectively preoperative data of charts for 3 years, 1993-1995. Blood counts, serum biochemical data, ECG were examined for each patient. Arterial blood gas analyses were performed for patients who had pulmonary dysfunction and who were 70 years old or more. We divided the patients into 3 groups; hip fracture patients (HF); patients of 70 years and over (70-Y); all patients (T). The T group include general surgical, orthopedic, gynecological, urologic, cardiovascular, neurological, oto-rhino-laryngological and plastic surgery. Mean ages were examined to be matched preliminary between the 70-Y group and the HF group. Hip fracture repair occurred about one week after injury. Patients were placed in traction beds with urinary drain until hip surgery. We counted number of co-existing diseases of lung, brain, kidney, and cardiovascular disease, malignancies and diabetes mellitus. Brain disease includes history of cerebral hemorrhage, cerebral infarction, dementia and mental disease.

We used one way ANOVA and unpaired student's t test to examine differences among groups. According to co-existing disease, we used chi-square test for independence. Statistical significance was accepted as $P < 0.05$.

Results

The number of the HF group undergoing operation was 87 (age; mean ± SE of 78 ± 0.9), male 18 (age; 73 ± 1.2) and female 69 (age; 79 ± 1.0). The ratio of men versus women was 1:3.8. The number of the T group was 2637 (age; 50 ± 0.4), male 1221 (age; 49 ± 0.7) and female 1418 (age; 52 ± 0.6). The number of the 70-Y group was 586 (age; 76 ± 0.2), male 253 (age; 75 ± 0.4) and female 333 (age; 77 ± 0.3).

RBC, Hb, and Hct were higher in the T group than in the 70-Y group ($P < 0.001$) and the HF group ($P < 0.01$, 0.01, 0.001 respectvely). RBC and Hb were higher in the 70-Y group than in the HF group significantly ($P < 0.05$). Means ± SE of Hb were 12.8 ± 0.04 g/dL (T group), 12.0 ± 0.08 g/dL (70-Y group) and 11.5 ± 0.16 g/dL (HF group). The WBC in men was lower in the 70-Y group than in the T group ($P < 0.05$). In women and total the WBC was higher in the HF group than in the 70-Y group ($P < 0.01$) and the T group significantly ($P < 0.001$). Plt was higher in the T group than in the 70-Y group ($P < 0.001$) and the HF group ($P < 0.01$).

Total protein (T. P.) was higher in the T group than in the 70-Y group ($P < 0.001$) and the HF group ($P < 0.001$). Total protein in total was higher in the 70-Y group than in the HF group ($P < 0.05$). BUN was greater in the 70-Y group than in the T group ($P < 0.001$). Creatinine was greater in the 70-Y group than in the T group ($P < 0.05$). Mean of FBS was higher in the HF group (124.3 ± 5.0mg/dL) than in the T group (109.2 ± 0.8mg/dL) ($P < 0.01$) and the 70-Y group (112.8 ± 1.8mg/dL) ($P < 0.05$). PH and base excess (B.E.) were higher in the HF group than in the T group ($P < 0.01$) and the 70-Y group ($P < 0.001$, 0.01). PaO_2 was lower in the HF group (73.3 ± 1.4mmHg) than in the T group (84.5 ± 0.7mmHg) ($P < 0.001$) and the 70-Y group (81.5 ± 0.9mmHg) ($P < 0.001$).

RBC, Hb and Hct were lower in women than in men in the T group ($P < 0.001$). Plt was higher in women than in men in the T group ($P < 0.01$). The WBC in men was higher than in women in the T group ($P < 0.01$), but didn't differ in the 70-Y group and the HF group. GOT and GPT in the T group were higher in men than in women ($P < 0.001$). PaO_2 levels were lower in women than in men in the T group ($P < 0.01$) and the 70-Y group ($P < 0.05$) (Table 1).

Prevalence of lung disease, diabetes mellitus, brain disease, malignancies and cardiovascular disease were less in the T group than in the 70-Y group ($P < 0.001$) and the HF group ($P < 0.001$). Prevalence of renal dysfunction was less in the T-group than in the 70-Y group ($P < 0.001$). Prevalence of brain disease was less in the 70-Y group than in the HF group ($P < 0.01$) (Table 2).

Discussion

Riggs RB et al. have shown that the ratio of men versus women is 1:6 in postmenopausal osteoporosis (Type I) and is 1:2 in senile osteoporosis (Type II) [6]. There is a tendency to vertebral fractures in type I and a tendency to hip fractures in type II. Each cause of hip fracture with osteoporosis in this study is not determined. The 87 cases of hip

fracture we reported may be the mixture of both types due to the ratio of 1:3.8. This study includes one of hyperparathyroidism (Type III) and one of hyperthyroidism. There are many hip fracture patients with diabetes mellitus in this study. Diabetes mellitus is a cause of osteopenia [7, 8].

According to comparisons between total cases and elderly people, there were differences in blood counts, total protein, renal function. Elderly people have decreases in absorption and production of protein. Decrease in renal function with age is recognized commonly.

There are some reports about anemia in the aged [9, 10, 11]. The tendency for senile anemia which consists of decreases in RBC, Hb and Ht is the likely cause of the differences between the T group and the 70-Y group in this study. Counts of white cell and platelet were reported to be decreased or unchanged. There are two main types of anemia in elderly patients. One shows decreases in iron level and ferritin level while the other doesn't show any causes associated with low erythropoietin. The latter is senile anemia. Administration of iron is effective for patients with iron deficiency anemia. Erythropoietin might be effective in patients with severe senile anemia [9].

Comparisons in blood counts between the 70-Y group and the HF group showed lower RBC and Hb in the HF group, likely due to the bleeding from the fracture site. Lower RBC and Hb in the HF group might base on the tendency to anemia in elderly patient. Decrease in Plt in the HF group was not significant. Responses of Plt to bleeding may be earlier than that of red cell formation. Plt may be decreased due to inflammatory response to injuries. Decrease in Plt was reported to be controlled by aprotinin given 3 days after admission. But maintaining Plt by aprotinin couldn't raise Hb or PaO_2 [12]. Erythropoietin controls the formation of red cell and thrombopoietin participates in the regulation of the formation of platelet from megakaryocytes [13, 14, 15]. Thrombopoietin requires iron. But iron deficiency normally acts to compensate platelet production except in the presence of severe iron deficiency.

Osteoclasts are derived from granulocyte-macrophage progenitor cells those were reported not to decrease with age [16]. Increase in WBC in the HF group is likely due to inflammatory response to injuries. It is unknown if the increase in osteoclasts production affect the formation of white cell. Lymphocyte counts is reported to decrease with age [17].

There was the tendency for hypoxia in hip fracture patients as well as the previous study [12]. It is caused in elderly patients by bed rest and the limitation of movement. Staying in bed for long period might decrease PaO_2 level due to increase in physiological dead space. The tendency to metabolic alkalosis of increases in PH and B.E. in the HF group may be related to the extravascular volume depletion due to bed rest.

Blood counts, total protein, liver transaminase, BUN and creatinine are commonly higher in men than in women. Plt was significantly higher in women than in men in this study. There are few reports about difference in platelet between men and women. Platelet has short life span of 9-12 days and one third of pool in the spleen and extravascular sites. Plt may be various with subjects in various conditions. Estrogen physiologically decreases platelet adhesiveness. Estrogen replacement therapy may increase platelet aggregation response to cathecholamines. Less Plt in men in this study may be, in part, a result of greater consumption for repair of vessel damage in men than in women due to less preservation of endothelium by estrogen. Effect of thrombopoietin on gender is unknown.

There are few reports about differences in PaO_2 between sexes. Hypoxia decreases testosterone level. Testosterone raises paO_2 level [18]. Progesterone increases PaO_2 level too [19]. There were differences in PaO_2 between men and women in this study.

There were substantial differences in prevalence of co-existing diseases between the T group and the 70-Y group. Malignancies, diabetes mellitus and lung, brain, kidney and cardiovascular diseases increase in prevalence with age. There were no significant differences in prevalence of diabetes mellitus between the HF group (18%) and the 70-Y group (12%). High glucose level in the HF group was caused partly by diabetes mellitus. Two of the 16 diabetic patients in the HF group were given insulin. The report showed that level of 24, 25-$(OH)_2D$ in insulin-dependent diabetic patients is the same low level as patients treated with oral drug and diet [20]. Bone mass is lower in adult mild diabetic patients than in juvenile severe diabetic patients [8]. It is not known if diabetes mellitus affects osteoporosis. Prevalence of brain disease was higher in the HF group than in the 70-Y group. It is possible that these deficits facilitated falls resulting in hip fracture. Neurological deficits may

be one potential cause of falls [21].

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Table 1
Perioperative Data

		T group			70-Y group			HF group		
		T	F	M	T	F	M	T	F	M
	Av	***425.7	###***413.4	***440.2	∴391.1	##∴384.0	401.2	σσ373.6	σσ368.3	σσ394.1
RBC	SE	1.21	1.48	1.88	2.47	3.1	3.96	5.53	6.39	9.53
10000/μL	N	2560	1383	1177	569	329	240	87	69	18
	Av	***12.8	###***12.2	***13.4	∴12.0	##17.7	12.4	σσ11.5	##σσ11.3	σ12.3
Hb	SE	0.04	0.04	0.06	0.08	0.09	0.13	0.16	0.18	0.34
g/dL	N	2564	1385	1179	570	330	240	87	69	18
	Av	***37.6	###***36.3	***39.1	35.6	34.9	36.5	σσσ34.5	σσσ34.0	36.6
Ht	SE	0.11	0.12	0.17	0.22	0.27	0.35	0.46	0.52	0.83
%	N	2562	1384	1178	570	330	240	87	69	18
	Av	6758	##6454	*7115	∴∴∴6589	∴∴∴6596	6580	σσσ8247	σσσ8468	7398
WBC	SE	61.5	72.2	102.5	138.2	168.9	232.1	921.2	1155	487.6
100/μL	N	2566	1387	1179	571	331	240	87	69	18
	Av	***24.1	##***24.5	***23.5	22.3	22.8	21.6	σσ21.2	σσσ20.7	23.3
Plt	SE	0.16	0.22	0.24	0.35	0.46	0.52	1	0.99	3.11
10000/μL	N	2538	1374	1164	564	326	238	87	69	18
	Av	***6.94	###***7.00	***6.87	∴6.64	6.68	6.59	σσσ6.48	σσσ6.45	6.59
T.P.	SE	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.08	0.13
g/dL	N	2471	1340	1131	549	320	229	86	68	18
	Av	***16.0	##***15.5	***16.7	19.3	18.5	19.9	σ18.5	18.9	17
BUN	SE	0.2	0.223	0.33	0.5	0.48	0.75	0.71	0.83	1.27
mg/dL	N	2504	1359	1145	561	325	236	85	67	18
	Av	*0.99	###0.92	1.08	1.07	###0.99	1.18	0.9	0.89	0.93
Cr	SE	0.016	0.02	0.026	0.026	0.032	0.043	0.033	0.039	0.061
mg/dL	N	2494	1358	1136	559	325	234	85	67	18
	Av	23.1	###20.7	25.9	23.4	22.4	24.8	20.8	19.9	24.3
GOT	SE	0.36	0.36	0.64	0.75	0.98	1.17	1.05	0.99	3.29
IU/L	N	2524	1364	1160	565	327	238	87	69	18
	Av	20.3	###16.9	**24.3	18	#16.4	20.1	σ14.5	##13.2	19.4
GPT	SE	0.44	0.54	0.69	0.79	0.98	1.29	0.92	0.9	2.56
IU/L	N	2524	1364	1160	565	327	238	87	69	18
	Av	27.4	##20	36.3	28.8	#24.3	34.4	18.8	#15	32.5
γ-GTP	SE	1	1.1	1.7	2.5	2.9	4.3	3.3	2	13.3
IU/L	N	1934	1057	877	432	241	191	65	51	14
	Av	109.2	**108.9	109.6	∴112.8	#116.9	108	σσσ124.3	σσ125.6	119.5
FBS	SE	0.8	1.1	1.2	1.8	2.5	2.5	5	5.3	14
mg/dL	N	2256	1245	1011	514	303	209	79	63	16
	Av	84.5	##82	86.8	∴∴∴81.5	#∴∴79.9	83.6	σσσ73.3	σσ72.6	σ77.8
PaO_2	SE	0.66	1.09	0.78	0.91	1.41	0.97	1.38	1.59	2.37
mmHg	N	939	438	501	413	236	177	83	66	18
	Av	41.5	41.7	41.4	41.3	#41.6	40.6	41.9	41.7	42.7
$PaCO_2$	SE	0.17	0.25	0.23	0.27	0.37	0.39	0.54	0.62	1.11
mmHg	N	937	437	500	413	236	177	83	65	18
	Av	7.42	###7.43	7.42	∴∴∴7.43	#∴∴∴7.43	7.42	σσ7.45	#σσ7.45	7.43
PH	SE	0.0013	0.0019	0.0018	0.002	0.0026	0.003	0.003	0.0037	0.0071
	N	940	438	502	414	237	177	83	65	18
	Av	3.16	3.41	2.93	∴∴3.11	##∴∴3.56	∴2.51	σσ4.83	σσ4.99	4.26
B.E.	SE	0.13	0.18	0.18	0.16	0.22	0.2	0.35	0.43	0.5
	N	926	433	493	408	235	172	83	65	18

significant difference between male snd female, # : P < 0.05, ## : P < 0.01, ### : P < 0.001 Av .: Average
significant difference between T group and 70-Y group, * : P < 0.05, **P : < 0.01, *** : P < 0.001 SE : Standad Error
significant difference between 70-Y group and HF group, ∴ : P < 0.05, ∴∴ : P < 0.01, ∴∴∴ : P < 0.01N : Number
significant difference between T group and HF group, σ : P < 0.05, σσ : P < 0.01, σσσ : P < 0.001

Table 2 Prevalence and Number of CO-existing Disease

	T group	70-Y group	HF group
	2637cases	586cases	87cases
lung disease	***246(9%)	112(19%)	σσσ21(24%)
diabetes mellitus	***181(7%)	68(12%)	σσσ16(18%)
brain disease	***138(5%)	∴∴76(13%)	σσσ21(24%)
malignancies	***158(6%)	67(11%)	σσσ16(18%)
renal dysfunction	***112(4%)	61(10%)	5(6%)
liver dysfunction	170(6%)	61(10%)	5(6%)
cadiovascular disease	***310(12%)	210(36%)	σσσ54(62%)

significant difference between T group and 70-Y group, *** : P < 0.001
significant difference between 70-Y group and HF group, ∴∴ : P < 0.01
significant difference between T group and HF group, σσσ : P < 0.001