Impact of the Holocaust on the Rehabilitation Outcome of Older Patients Sustaining a Hip Fracture

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ABSTRACT:

Background: Holocaust survivors report a much higher prevalence of osteoporosis and fracture in the hip joint compared to those who were not Holocaust survivors.

Objectives: To evaluate whether being a Holocaust survivor could affect the functional outcome of hip fracture in patients 64 years of age and older undergoing rehabilitation.

Methods: A retrospective cohort study compromising 140 consecutive hip fracture patients was conducted in a geriatric and rehabilitation department of a university-affiliated hospital. Being a Holocaust survivor was based on registry data. Functional outcome was assessed by the Functional Independence Measure™ (FIM) at admission and discharge from the rehabilitation ward. Data were analyzed by t-test, chi-square test, and linear regression analysis.

Results: Total and motor FIM scores at admission ($P = 0.004$ and $P = 0.006$, respectively) and total and motor FIM gain scores at discharge ($P = 0.008$ and $P = 0.004$ respectively) were significantly higher in non-Holocaust survivors compared with Holocaust survivors. A linear regression analysis showed that being a Holocaust survivor was predictive of lower total FIM scores at discharge ($\beta = -0.17$, $P = 0.004$).

Conclusion: Hip fracture in Holocaust survivors showed lower total, motor FIM and gain scores at discharge compared to non-Holocaust survivor patients. These results suggest that being a Holocaust survivor could adversely affect the rehabilitation outcome following fracture of the hip and internal fixation.

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KEY WORDS: functional outcome, hip fracture, Holocaust survivor, rehabilitation

Among older patients, hip fractures are a leading cause for hospital admission and prolonged hospitalization [1]. These fractures cause functional impairments and severe disabilities, and as a result are accompanied by high rates of institutionalization and mortality [2]. Studies have shown an association between environmental factors during the prenatal period, childhood, and adolescence and peak bone mass, bone mineral density, and bone fracture as a result of osteoporosis among elderly patients [3-5]. Genetic factors, body weight, nutrition, hormonal status and physical exercise also influence peak bone mass [4]. Decreased peak bone mass has been shown to play an important role in the development of osteopenia and osteoporosis [6]. It has been shown that adverse social, environmental and biomedical factors from an early age may have a long-term impact on health and aging [7].

One group of people exposed to harsh conditions of deprivation and under-nutrition in early life are Holocaust survivors. Some of these survivors suffered from malnutrition. Others were in hiding and thus not able to undertake physical activity and were not exposed to sunlight. As a result they suffered from a lack of vitamin D [8]. "Hunger osteopathy," which is a bone disease that develops during starvation, was diagnosed among Warsaw Ghetto survivors and others after World War II [9]. In a study conducted in Israel in 1997 among Jewish immigrants from Europe aged 60 or older, Holocaust survivors reported a much higher prevalence of osteoporosis and fracture in the hip joint compared to those who were not Holocaust survivors [10].

In a self-report study, which included 3022 Jewish community-dwelling men and women who provided information about themselves, the prevalence of a history of hip fracture was threefold higher among survivors of concentration camps vs. controls (11.4% vs. 3.9%) [11]. Our vast clinical experience with Holocaust survivors not only confirmed these reports but also raised the question whether their recovery following hip fracture rehabilitation was less successful than that of patients who were not Holocaust survivors. The purpose of the present study was to compare the in-hospital rehabilitation outcome of Holocaust survivors with that of non-Holocaust survivors after hip fracture and fixation operation.

PATIENTS AND METHODS

The basic hypothesis of this study was that being a Holocaust survivor adversely affects the functional outcome of hip fracture patients, compared with non-Holocaust survivors. Therefore, the study was designed to evaluate the functional outcome achieved by patients after surgery to repair a fracture of the femoral head joint during the inpatient rehabilitation period.

The study included 140 consecutive patients admitted to our geriatric rehabilitation ward from orthopedic departments of a general hospital during a 3 year period (2012–2015). We included patients aged ≥ 64 years admitted after pertrochanteric (extra-capsular) or subcapital (intracapsular) hip fracture, and in stable

medical condition enabling immediate start of active rehabilitation therapy. Exclusion criteria included patients whose rehabilitation period was shorter than 7 days (assuming that the extent of rehabilitation in such a short period is limited and could distort results), suffered other acute disabilities such as multiple trauma, exhibited medical conditions preventing active rehabilitation (such as severe chronic lung disease necessitating constant use of oxygen, cardiac failure with functional capacity stage III-IV of the New York Heart Association Functional Classification, NYHA), were transferred to acute-care departments due to complications, or died. These criteria excluded patients with either medical or functional conditions that would have limited their rehabilitation potential. Complete medical details were extracted from each patient's medical chart. All rehabilitation patients were evaluated for cognitive level using the Mini-Mental State Examination (MMSE) [12], and were under close 24/7 observation by experienced medical and nursing staff. They were also interviewed and closely observed by a ward social worker and the rehabilitation personnel who were all blinded with respect to who was a Holocaust survivor and who was not. The multidisciplinary team met weekly to discuss the cooperation, behavior and rehabilitation progress of each patient. The level of disability of the patients was evaluated by the Functional Independence Measure™ (FIM) scale on admission and discharge [13]. The FIM scale assesses physical and cognitive disability. Items are scored on the level of assistance required for an individual to perform activities of daily living (ADL). The scale includes 18 items, of which 13 are physical domains and 5 cognition items. Each item is scored from 1 to 7 based on level of independence, where 1 represents total dependence and 7 indicates complete independence. Possible scores range from 18 to 126, with higher scores indicating more independence. Alternatively, the 13 physical items could be scored separately from the 5 cognitive items with total scores between 13

(minimum) and 91 (maximum). These scores are highly sensitive in detecting functional improvements.

We also calculated total FIM at discharge vs. total FIM at admission, and motor FIM at discharge vs. motor FIM at admission. Data on patient pre-fracture functional level was obtained from the patient or family members and was assessed as completely independent, partially/minimally dependent, or completely dependent in ADL and functional movement activities. The data in the report are based on the definition of a Holocaust survivor as a person who lived in one of the countries occupied by or under the influence of the Nazi regime for any length of time between 1933 and 1945. The survivor population also included those who were forced to leave their place of residence because of the Nazi regime [14]. The study was approved by the local ethics committee.

STATISTICAL METHODS

Comparisons between Holocaust survivors and non-Holocaust survivors related to a list of clinical and functional measures using paired t-tests for continuous variables, and chi-square tests for dichotomous variables. Linear regression analysis was performed to study simultaneously the independent relationship between demographic, clinical, cognitive and functional characteristics and total FIM at discharge. The statistical significance level (alpha) was set at 0.05. A Bonferroni correction was calculated according to the number of comparisons (t-tests) and alpha level was set at 0.0083. All statistical analyses were performed using the SPSS system for Windows, version 21.

RESULTS

The data of 140 consecutive hip fracture patients aged 64 and older admitted during a 3 year period were available for analysis. Their clinical and demographic characteristics are listed in Table 1. Mean age for all patients was 82.46 ± 6.74 years, women comprised 62.1% of the group. The patients included 41.4% Holocaust survivors, and of these, 42.9% were classified as being fully independent before the fracture. There were no statistically significant differences between Holocaust survivors (n=58) and other patients (n=82) by gender, or by co-morbid conditions such as diabetes mellitus, hypertension, hyperlipidemia, ischemic heart disease and atrial fibrillation, or by the Mini Mental State Examination (MMSE). Age (81.45 ± 7.16 vs. 83.9 ± 5.86 years, P = 0.034), previous stroke, and pre-fracture level of independence [independent, 42 (51.2%) vs. 18 (31%), partially dependent, 31 (37.8%) vs. 26 (44.8%), and totally dependent, 9 (11%) vs. 23 (24.1%)], respectively, P = 0.027, emerged as the only statistically significant parameters distinguishing non-Holocaust from Holocaust survivors [Table 1]. Non-Holocaust survivors presented to rehabilitation with a significantly higher total and motor-FIM scores, compared with Holocaust survivors, but the difference was not statistically significant [Table 2]. However,

Table 1. Clinical and cognitive characteristics of older patients with hip fracture

Variable	All patients (n=140)	Non-Holocaust survivors (n=82)	Holocaust survivors (n=58)	P value
Age, years	82.46 ± 6.74	81.45 ± 7.16	83.9 ± 5.86	0.034
Female gender	87 (62.1%)	52 (63.4%)	35 (60.3%)	0.712
Diabetes mellitus	52 (37.1%)	34 (42%)	18 (31%)	0.254
Hypertension	111 (79.31%)	68 (82.9%)	43 (74.1%)	0.206
Hyperlipidemia	65 (46.4%)	40 (48.8%)	25 (43.1%)	0.507
Ischemic heart disease	83 (59.3%)	51 (62.2%)	32 (55.2%)	0.405
Atrial fibrillation	25 (17.8%)	13 (15.8%)	12 (20.7%)	0.465
Previous stroke	22 (15.7%)	8 (9.8%)	14 (24.1%)	0.021
MMSE	16.53 ± 8.27	16.71 ± 8.66	16.28 ± 7.76	0.762
Pre-fracture level of independence Independent Partially dependent Totally dependent	60 (42.9%) 57 (40.7%) 23 (16.4%)	42 (51.2%) 31 (37.8%) 9 (11%)	18 (31%) 26 (44.8%) 23 (24.1%)	0.027

MMSE = Mini-Mental State Examination

Table 2. Functional characteristics of older patients with hip fracture

Variable	Non-Holocaust survivors	Holocaust survivors	P value
Total FIM at admission	61.71 ± 14.92	58.79 ± 13.49	0.239
Total FIM at discharge	81.34 ± 16.5	73.41 ± 14.33	0.004
Total FIM gain	19.63 ± 11.99	14.62 ± 9.08	0.008
Motor FIM at admission	32.51 ± 9.71	36.5 ± 8.69	0.527
Motor FIM at discharge	54.56 ± 12.61	49 ± 9.76	0.006
Motor FIM gain	17.05 ± 9.66	12.5 ± 7.75	0.004

FIM = Functional Independence Measure

Table 3. Linear regression analysis of factors predicting for total FIM at discharge

Independent predictors	β	P value
Holocaust survivors	-0.17	0.004
Age (years)	-0.186	0.003
Gender (female)	0.074	0.23
Ischemic heart disease	-0.027	0.725
Atrial fibrillation	-0.105	0.072
Arterial hypertension	-0.003	0.957
Diabetes mellitus	-0.079	0.286
Hyperlipidemia	0.034	0.581
Previous stroke	0.017	0.77
Pre-fracture function	-0.258	‹ 0.001
MMSE	0.489	‹ 0.001

FIM = Functional Independence Measure, MMSE = Mini-Mental State Examination

non-Holocaust survivor patients were discharged from the ward with better total ($P = 0.004$) and motor FIM ($P = 0.006$) scores. The total functional gain ($P = 0.008$) and motor FIM gain ($P = 0.004$) scores of non-Holocaust survivors were higher compared with the functional gains achieved by Holocaust survivor patients.

No abnormality was noticed with respect to behavior and cooperation in both groups. Since the non-Holocaust survivor group was younger, and in a better functional state at discharge, we performed a linear regression analysis to test for independent predictors of functional outcome at hospital discharge. The results of the regression analysis, with all independent variables entered simultaneously [Table 3], showed that total FIM at discharge was independently and inversely associated with age ($\beta = -0.186$, $P = 0.003$) and pre-fracture function ($\beta = -0.258$, $P < 0.001$). A higher MMSE score at admission ($\beta = 0.489$, $P < 0.001$) emerged as the factor predicting independently higher total FIM scores at discharge. Being a Holocaust survivor was predictive for low total FIM at discharge ($\beta = -0.170$, $P = 0.004$) overall. The model gave an R^2 value of 0.613, indicating that the variables in the regression model accounted for most of the total variance of the FIM scores.

DISCUSSION

The results of our study suggest that being a Holocaust survivor is associated with a significantly lower total, and motor FIM scores on discharge, as well as with fewer functional gains. However, non-Holocaust survivors were somewhat younger (difference of mean age 2.45 years), had a better pre-facture level of independence and were therefore expected to do better with rehabilitation. Thus, the question arises whether the rehabilitation results would have been expected to be slightly better in Holocaust survivors had the two groups been of the same age and pre-fracture level of independence. However, the results of the linear regression analyses showed that being a Holocaust survivor was an independent predictor of worse functional outcome, after accounting for the confounding effect of age and pre-fracture function. In fact, when age, gender and MMSE alone were entered into the model, the association of being a Holocaust survivor with FIM at discharge remained significant. The presence of a possible "Holocaust effect" is not

surprising, considering previous studies that observed an association between being a Holocaust survivor and higher prevalence of osteoporosis and hip fracture [10,11]. In particular, our findings concur with studies that found a higher prevalence of osteoporosis and fractures in older Holocaust survivors. Among Holocaust survivors aged 80 and older, chronic skeletal pain, cardiovascular problems, insomnia and severe headache are increasingly prevalent [15]. Holocaust survivors also suffer from a higher prevalence of emotional distress and anxiety disorders than do non-Holocaust survivors. Evidence has shown that survivors react more emotionally when they are forced to cope with a stressful life event such as illness or war [16].

Routine examination by a medical doctor, illness and specifically hospitalization were identified as situations that can increase Holocaust survivors' emotional reaction [17]. During hospitalization, Holocaust survivors develop psychotic symptoms such as delusions of being in the camps again. As a result, due to misinterpretation of the medical staff's actions and motives, the survivors may suffer from severe anxiety [18]. In a comparative study of 66 survivors and controls with chronic pain, survivors reported more pain sites, higher pain levels and significantly higher depression scores [19]. However, our thorough screening of the medical files and staff meeting recordings did not detect any behavioral problems and revealed good cooperation with the staff in both groups.

Recent publications relate the wide-ranging effects of vitamin D not only to the bone but to the muscle, including differentiation and development [20]. It is possible that being a Holocaust survivor results in loss of appendicular skeletal muscle mass and sarcopenia thus leading to poor health outcome and function. Such data might explain the difference in function abilities before hospitalization between survivors and non-survivors [21]. An interesting finding, although not a surprising one, is that more than 40% of our patients presenting with hip fracture were

Holocaust survivors. This is in contrast with the low relative number of Holocaust survivors in the Israeli population [14]. Our data may indicate that this population is at increased risk of falling and being diagnosed with hip fracture. Our data also support and extend results from previous studies showing that, in elderly hip fracture patients, pre-fracture function and lower MMSE scores independently predict low total FIM at discharge [22].

In a population-based retrospective cohort study of the Holocaust survivor population that came to Israel from Poland, Sagi-Schwartz et al. [23] found that Holocaust survivors live longer than non-Holocaust survivors. However, older age is a well-known risk factor for stroke [24]. These findings might explain why in our study the Holocaust survivors with hip fractures were older and had a higher percentage of stroke compared to non-Holocaust patients.

Possible limitations of our study include its retrospective nature and the way patients were selected. Our method of selecting patients may have affected the final results, since both relatively healthy Holocaust survivors and very unhealthy patients were excluded. However, rehabilitation was reserved precisely for those who were believed to benefit from rehabilitation, rather than those who were not, being in a too good (or bad) general condition. This was similar to other data showing that only two-thirds of hip fracture patients participate in post-acute rehabilitation programs [25]. Therefore, our sample represents the actual profile of hip fracture patients admitted for rehabilitation. Despite a careful adjustment made for important confounders, others could have been considered, particularly those relating to other functional parameters. Despite these limitations, the present study includes a large sample of patients, all of whom underwent a similar rehabilitation program in a ward dealing exclusively with treatment of hip fractures in older patients, thus decreasing any degree of selection bias or reducing the validity of the study. Above all, to the best of our knowledge, this is the first study focusing on the possible effect of being a Holocaust survivor on rehabilitation, while systematically using FIM as a structured assessment tool. Moreover, from a present and global perspective these results may point to a possibly detrimental late-life developmental effect caused by food insecurity and deprivation during early life anywhere and anytime.

CONCLUSIONS

Our findings suggest that Holocaust survivor patients achieve lower discharge FIM scores. After controlling for possible confounders, being a Holocaust survivor remains a significant predictor of lower discharge FIM scores. This implies that being a Holocaust survivor should be considered as adversely affecting rehabilitation following hip fracture.

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