

Mortality and Function after Hip Fractures in Different Ethnic Populations in Israel

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ABSTRACT: **Background:** Mortality and decrease in function after hip fracture are significantly related to patient factors including age, gender, co-morbidities, and mental status. Several studies demonstrated ethnic disparities in incidence, mortality, and functional outcome after hip fractures in the United States.

Objectives: To assess the relationship between ethnicity and hip fracture incidence and outcomes of mortality, functional change, and perioperative complications in the Israeli population.

Methods: We reviewed our institutional hip fracture registry for all patients from 2014–2015. Patients with incomplete data, < 60 years of age, or pathologic and periprosthetic fractures were excluded. Our study comprised 693 patients. Ethnicity was based on country of birth. Specifically, for those born in Israel, the nationality of either Jewish or Arab was further dichotomized. Perioperative complications, mortality, and mobility status at 1 year follow-up were recorded. The ethnicities of 27,130 patients admitted to the medicine and surgical wards during the same time interval served as a control group for the hip fracture cohort.

Results: Immigrants from Europe and America had the highest incidence of hip fractures. Fracture types varied in incidence in groups with 70% of extracapsular hip fractures occurring in Arabs and immigrants from Eastern countries, compared to 60% in immigrants from Western countries and the former Soviet Union. Mortality, perioperative complications, and mobility at 1 year were similar in all ethnic groups.

Conclusion: Our study demonstrated significant differences in incidence and fracture characteristic among ethnicities, but no difference in patient outcome. These findings differed from the available North American studies.

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ity of life. Numerous studies have investigated the traditional demographic and clinical factors that correlate with increased mortality and functional decline [2-9]. The most significant are patient factors including age, gender, medical co-morbidities, and mental status.

Several studies have demonstrated ethnic disparities in incidence, mortality, and functional outcome after hip fractures in the United States. Although white Americans had a higher incidence of hip fractures than minorities, whites had significantly better outcomes in mortality and function [9-13]. Only a few studies examined the role of ethnicity and hip fracture outcomes outside the United States. Similarly in the United Kingdom, hip fracture incidence among whites was the highest, followed by Asians and blacks [14]. A recent meta-analysis demonstrated worldwide variation in hip fracture incidence, with the highest in Europe and North America, followed by Asia, and the lowest in Africa and Latin America [15]. A north-south gradient in hip fracture incidence was tangibly demonstrated. Regarding mortality, Pereira and colleagues [16] showed no difference among ethnicities in Brazil. In a recent meta-analysis examining gender and ethnicity variability in hip fracture incidence and outcomes, principally in North American and Northern European populations, the authors conclude that there is a lack of global research with insufficient inclusion of minority patients to draw meaningful conclusions [17].

Israel is an immigrant society. Along with Israeli born Jews and Arabs, the country has absorbed multiple iterations of primarily Jewish immigrants from several areas of the world over the past 135 years [18]. The most recent wave of immigration was from the former Soviet Union in the early 1990s and Ethiopia during the 1980s and 90s. The diversity of the immigrant population is apparent in ethnicity, culture, and overall health profile [18,19]. A recent study demonstrated that the varied immigrant groups in Israel have been exposed to different quantity and patterns of trauma in recent history [20].

The primary objective of this study was to assess the relation of ethnicity and hip fracture-related mortality and functional outcome in one hospital located in central Israel. A secondary

Hip fractures are the most common traumatic indication for hospitalization and surgery in the elderly [1], and the fractures carry considerable morbidity, mortality, and lower qual-

objective was to estimate the ethnic disparity of hip fracture incidence in the populations served by the hospital.

PATIENTS AND METHODS

The study utilized an institutional hip fracture registry at an academic level II trauma center. The hospital is located in a dense urban environment and serves a diverse population of approximately 500,000 people. The database is operated by a research coordinator and data are collected by the treating surgeons. Data about hip fractures were collected at admission, after surgery, and at discharge from the hospital. Follow-up telephone interviews were conducted at 1 year postoperatively. Registry data collection and analysis were approved by the institutional review board.

All 735 patients admitted to the hospital with the diagnosis of hip fracture between January 2014 and December 2015 were included in the study. Patients younger than 60 years old and those with pathologic and periprosthetic hip fractures were excluded from analysis. The study included 693 fractures in 679 patients. Mean age was 82.4 ± 7.93 years (range 60–113 years); 489 were females (70.56%).

The hospital database included demographic data including age, gender, and ethnicity, and was cross-referenced with the government civil registry. Ethnicity was determined by

country of birth. Those who were Israeli born were further dichotomized into Jewish or Arab nationalities.

Countries of birth were grouped into geographic clusters:

- Former Soviet Union (FSU)
- East (ES) including North Africa and the Middle East
- West (WS) including Europe and North America
- Ethiopia (AF)
- Other (OT)

Israeli born were separately grouped

- Arab ethnicity (AR)
- Jewish ethnicity (IJ)

The type of fracture (extracapsular or intracapsular), surgical delay (time between admission and surgery), and American Society of Anesthesiologists (ASA) scores were documented. Major complications were defined by the requirement of further open surgery (not including minor superficial debridement and reduction of simple dislocations under anesthesia).

Assessment of baseline pre-fracture outdoor mobility and 1 year post-fracture follow-up was performed via a modified British National Hip Fracture Database Scoring system, adjusted to local culture: freely mobile without aids (1), mobile outdoors with a cane (2), mobile outdoors with a walker (3), no functional mobility or limited indoor mobility (4) [21].

The total hospital admission cohort to internal medicine and general surgery wards during the same period of time was used as a control group; it corresponded to the global ethnic distribution of the population served by the hospital. Of 37,955 patients admitted between 2014 and 2015, we excluded 9440 patients younger than 60 years of age, 1372 patients for whom ethnicity was not available, and 13 whose ethnicity was other (OT). Ultimately, 27,130 patients were available for analysis. Mean age was 78.7 ± 9.7 (range 60–113); 14,424 (53%) were females.

STATISTICAL ANALYSIS

Gender, ASA score, fracture type, complications, and pre-fracture mobility were compared using chi-square statistics. Age and surgical delay were compared using the one-way analysis of variance (ANOVA). *P* values of < 0.05 were considered to be statistically significant. Statistical analyses were performed using MedCalc® V6.8 software (MedCalc Software, Mariakerke, Belgium).

RESULTS

Comparison of ethnic distribution within the hip fracture group to the control group showed a significant difference [Table 1]. Patients within the WS group constituted a significantly larger part of the hip fracture cohort than of the control group ($P < 0.0001$). There was a trend toward an opposite conclusion within the FSU group ($P = 0.052$). Stratifying the

Table 1. Ethnic distribution of patients with hip fracture and patients admitted to departments of internal medicine and general surgery

Country or region of birth	Israel: Jewish ethnicity	Israel: Arab ethnicity	North Africa or the Middle East	Europe or North America	Former Soviet Union	Ethiopia	Total	<i>P</i> value
All patients								< 0.0001*
Hip fracture cohort	70 (10.1%)	8 (1.15%)	255 (36.8%)	183 (26.41%)	176 (25.4%)	1 (0.14%)	693	
Internal medicine and general surgery	3222 (11.87%)	522 (1.92%)	10,298 (37.96%)	5180 (19.09%)	7811 (28.79%)	97 (0.36%)	27,130	
Females								0.02
Hip fracture cohort	44 (9.00%)	5 (1.02%)	173 (35.80%)	123 (25.15%)	143 (29.24%)	1 (0.20%)	489	
Internal medicine and general surgery	1494 (10.36%)	265 (1.84%)	5380 (37.30%)	2761 (19.14%)	4461 (30.93%)	55 (0.38%)	14,416	
Males								0.001
Hip fracture cohort	26 (12.75%)	3 (1.47%)	82 (40.20%)	60 (29.40%)	33 (16.18%)	–	204	
Internal medicine and general surgery	1728 (13.59%)	257 (2.02%)	4918 (38.67%)	2419 (19.02%)	3350 (26.34%)	42 (0.33%)	12,714	

**P* value represents the probability of no association between ethnicity and the different categories in each sub-table

groups further by gender, the difference within the WS group persisted and was significantly more pronounced in males. Males of the FSU group had a significantly lower prevalence in the hip fracture cohort compared to controls.

Table 2 shows demographic and clinical data of the hip fracture population by ethnicity. Analyses of baseline patient characteristics show no difference in pre-injury ambulatory ability and ASA scores. However, there were significant age and gender differences among the groups. Although 70% of the total hip fracture population were female, the FSU group was more disproportionate with 81% female. In the other immigrant groups (ES and WS) 67% to 68% of patients were female. Within the Israeli born patients (IJ and AR), 63% were female. Immigrants (FSU, WS and ES) sustaining hip fractures were significantly older than patients born in Israel (AR and IJ). Fracture type varied significantly among the groups as well. While the AR and ES populations sustained 72% to 75% of the extracapsular fractures, WS and FSU were significantly lower (60%–64%). Furthermore, the IJ population was diagnosed with extracapsular hip fractures 53% of the time.

We found no differences in hip fracture post operative outcomes among ethnic groups [Table 3]. Mortality was similar, including prevalence of early mortality ($P = 0.39$) and 1 year mortality ($P = 0.44$). Mobility status was comparable among the groups. Most patients in all ethnic groups were walker dependent for outdoor ambulation at 1 year postoperatively. At focused assessment of the select 373 patients with preoperative independent outdoor ambulation without cane or walker, no difference in the 1 year mobility status was found among ethnicities ($P = 0.10$). Major complication rates were also similar among groups.

DISCUSSION

High rates of mortality, morbidity, and loss of function are common after hip fractures in the elderly. Among several patient-related factors, ethnicity and race are determinants of post-fracture outcomes according to the literature originating in America and Europe. Studies have consistently shown an outcome advantage for the white population over minorities. Conversely, the incidence of hip fractures is considerably higher in the white population in the same geographic region. This result is theoretically related to differing proximal femoral anatomy among groups and other genetic and environmental factors. There is no conclusive evidence to suggest an unifying etiology [17,22,23].

The current study examined the incidence and outcome of hip fractures in different ethnic groups in an Israeli hospital. Each group demonstrated similar rates of mortality, mobility loss, and complications at 1 year follow-up. Alternatively, our data confirm group-specific disparities in fracture incidence, fracture type, patient age, and gender distribution.

Table 2. Demographic and clinical data by ethnic group

Country or region of birth	Israel: Jewish ethnicity	Israel: Arab ethnicity	North Africa or the Middle East	Europe or North America	Former Soviet Union	Ethiopia	P value
Number	70	8	255	183	176	1	
Percentage	10.10%	1.15%	36.80%	26.41%	25.40%	0.14%	
Females	44 (63%)	5 (63%)	173 (68%)	123 (67%)	143 (81%)	1	0.007
Age, years (mean ± standard deviation)	76.8 ± 9.4	77.6 ± 10.5	81.7 ± 7.2	84.3 ± 7.4	83.9 ± 7.6	75	0.001
ASA score							0.74
1	3	–	9	3	4	–	
2	39	4	153	98	107	–	
3	28	4	93	81	63	1	
4	–	–	–	1	2	–	
Pre-fracture outdoor mobility							0.70
Free	38 (54.3%)	5 (62.5%)	139 (54.5%)	103 (56.3%)	91 (51.7%)	1	
Cane	13 (18.6%)	1 (12.5%)	52 (20.4%)	28 (15.3%)	35 (19.9%)	–	
Walker	15 (21.4%)	2 (25%)	60 (23.5%)	49 (26.8%)	41 (23.3%)	–	
Limited	4 (5.7%)	–	4 (1.6%)	3 (1.6%)	9 (5.1%)	–	
Fracture type							0.03
Extracapsular (65%)	37 (53%)	6 (75%)	183 (72%)	110 (60%)	113 (64%)	1	
Intracapsular (35%)	33 (47%)	3 (25%)	72 (28%)	73 (40%)	63 (36%)	–	
Surgical delay, hours (mean ± SD)	32.6 ± 36	28.1 ± 31	33.7 ± 43	32.1 ± 39	32.5 ± 36	31	0.833

Table 3. One year outcomes of hip fractures by ethnic group

Country or region of birth	Israel: Jewish ethnicity	Israel: Arab ethnicity	North Africa or the Middle East	Europe or North America	Former Soviet Union	Ethiopia	P value
Mortality							0.66
Within 30 days	3 (4.3%)	0	7 (2.8%)	13 (7.1%)	9 (5.1%)	–	0.39
30 days –to 1 year	9 (12.9%)	2 (25%)	36 (14.1%)	32 (17.5%)	27 (15.3%)	–	
Survived the first year	58 (82.9%)	6 (75%)	212 (83.1%)	138 (75.4%)	140 (79.6%)	1	0.44
Outdoor mobility							0.32
Free	9 (18.4%)	1 (16.7%)	19 (9.8%)	22 (18.0%)	15 (13.3%)	–	
Cane	15 (30.6%)	1 (16.7%)	53 (27.5%)	29 (23.8%)	34 (30.1%)	–	
Walker	21 (42.9%)	2 (33.3%)	94 (48.7%)	44 (36.1%)	48 (42.5%)	1	
Limited	4 (8.2%)	2 (33.3%)	27 (14.0%)	27 (22.1%)	16 (14.2%)	–	
Complications (number)	1 (1.4%)	0	9 (3.5%)	7 (3.8%)	7 (4%)	0	0.9

This study has several limitations. First, it was conducted at one hospital that serves a population of mostly Jews born outside of Israel and may not be generalizable to Israel as a whole. Second, calculations of fracture incidence were based on a control group of patients admitted to the hospital, with the

assumption of representation of the total ethnic distribution of the population served by the hospital. The control group was comprised of age-matched patients admitted to internal medicine and general surgery wards, with an effort to decrease bias.

A recent meta-analysis of mainly North American studies by Sterling [17] demonstrated that minorities who sustained a hip fracture were significantly younger and more medically complicated than whites, but the incidence of hip fractures was higher in whites [9-15]. Similarly, our study found a higher incidence of fractures in people born in Europe and North America. No differences were found in the groups regarding the status of the patient's general health, as indicated by a statistically uniform ASA score. Israeli born patients fractured their hip at a significantly younger age than immigrants. Regarding patient factors, 18% of the patients were male within the FSU group while the proportion of male hip fracture patients in other groups were roughly one-third. Differences in fracture-type distribution were also noted. While more than 70% of fractures in the AR and ES groups were extracapsular, only 60% of fractures in the WS and FSU groups and 50% in the IJ group were extracapsular.

Differences in hip fracture incidence, fracture type, patient gender, and medical condition among ethnic groups are likely multifactorial and may include anatomic, metabolic, socio-economic, and cultural variations. Differences in outcomes may also be affected by treatment availability and quality, a further consideration for patients in countries lacking universal health coverage. Although there is a relative paucity of research on the outcome of hip fractures relating to patient ethnicity, it was shown that in the United States, the mortality and functional outcome are better for whites than for racial minorities [17]. In the Israeli health system, the availability and quality of acute fracture treatment is similar for all citizens. Our data demonstrated similar surgical delay times, rate of early and late complications, functional outcome, and mortality for all groups.

CONCLUSIONS

Little is known about the role of ethnicity in the setting of hip fractures outside the United States. Our study demonstrated differences in hip fracture incidence and fracture characteristics in groups, but no difference in outcome. These findings vary from existing North American literature. As countries endeavor to establish prudent health policies and allocate resources based on anticipated need of local health systems, larger studies on a national level in Israel and other countries are necessary.

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