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Demographic Data of Cystic Fibrosis Patients in a Tertiary Care Center in Saudi Arabia

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Abstract

Introduction: Cystic Fibrosis has been reported before in almost all Arab countries with an incidence ranges from 1:2500- 1:7000. Presentations varied, but mainly due to recurrent chest infection and Pancreatic Insufficiency. Median survival has been far below North American countries. Delayed diagnosis and delayed management account for the low median survival.

Objectives: To present the demographic data of Cystic Fibrosis patients and their families, that involves their social status and education.

Methodology: A retrospective chart review as part of the Cystic Fibrosis registry data from the period January 1998 to December 2018. All confirmed CF patients of all age groups who contributed their demographic information were included and analyzed.

Results: A total of 430 confirmed Cystic Fibrosis patients. 236 (96%) patients survived, and 10 (4%) died. Two hundred and thirteen (49.5%) were males, and 217 (50.5%) were females. Eighty-three percent consanguinity rate. Forty-five had a family history of Cystic Fibrosis, and the diagnosis was suggested by family history in 9.5% of patients. 415 (98.1%) were of Saudi nationality. 156 (36.5%) were from the Eastern province. The mean age at diagnosis was 3.46 years (SD±5.547). Median survival around 22 years. Mean Sweat chloride was 92.04 mmol/ L (17.343). In reviewing the educational level of 247 patients, the level of elementary school accounted for 90 (36.1%) of patients, 24 (9.7%) of mothers, and 21 (8.5%) of fathers. Similarly, 43 (17.4%)/ 22 (8.9%)/ 102 (41.3%) were in the preparatory level, 35 (14.3%)/ 43 (17.4%)/ 51 (20.6%) were in the high school level, and 23 (9.3%)/ 39 (15.8%)/ 46 (18.6%) were in the college level, respectively. Regarding the employment: 145 (58.7%) patients are students, 3 (1.2%) are part-time employees, and 15 (6.0%) are full time employees. 207 (83.8%) mothers are housewives, 2 (0.8%) are students, and 29 (11.7%) have full-time employment. Paternal

employment showed that 210 (85.0%) are full time, and 7 (2.8%) are part-time employees. Regarding their accommodation: 77 (31.2%) of Cystic Fibrosis parents owned a villa, 81 (32.8%) rented an apartment, and 79 (32%) owned their own apartment.

Conclusion: More than 2/3 of CF patients are students at the elementary school level, and only 6.0% have a full-time job, which makes them completely dependent on both parents for their care. Median survival improved from 8 years in 1984 to 22 years. Further efforts need to be applied to different aspects of care to further improve median survival.

Keywords

Cystic fibrosis, Epidemiology, Education, Socioeconomic Status, Consanguinity, Survival, Arabs

Introduction

Cystic fibrosis (CF) is an autosomal recessive disorder caused by a mutation in the gene encoding a protein which functions as a chloride channel [1]. The chloride channel, cystic fibrosis transmembrane conductance regulator (CFTR) exists in the apical membrane of exocrine epithelial cells in the body. In the last 75 years, the survival of CF patients has risen dramatically from a few months to the average age of 45 years [1]. The rise in life expectancy is due to several reasons: improved medical treatment, treating patients in specialized CF centers, early diagnosis, respiratory physiotherapy, and liver or lung transplantation [1].

Demographics, Incidence/Prevalence, Survival:

The prevalence of CF in Arab countries is estimated to range from 1:2,560 to 1:15000 [1,2] (**Table-1**), likely owing to ethnicity and the degree of consanguinity which is estimated at approximately 65% [3]. In the UAE, the prevalence of CF was estimated to be 1 in 15,876 [4]. The incidence rate of CF is 1 in 2500 live births in Jordan and 1 in 5000 live births in Bahrain [5-7]. The median survival in Arab countries is low, estimated at 10-20 years of age [1,2] (**Table-1**). In 2004, a study of 27 European (EU) countries showed that the mean prevalence of CF was 0.737 per 10,000 [8] and a mean age of 45-50 years [9-12].

In a cross-sectional study, disease severity was inversely correlated with socioeconomic factors such as median household income by zip code and state insurance coverage. Patients with low socioeconomic status (SES), however, were treated more aggressively by healthcare providers who likely recognize those patients' likelihood of worse disease outcomes. A 2011 study found that individuals of higher SES were more likely to die above the median survival age [13]. Children of higher socioeconomic groups, living in upscale areas or with well-educated mothers, were more likely to be better informed on their disease and receive better healthcare at clinics [14]. Oates et al. found that maternal college education, annual income >$50,000, and more adults in the household were independently correlated with better treatment adherence [15]. Socioeconomically disadvantaged patients had limited access to specialist care centers in the UK [13]. A literature review of demographics and the effect of social and economic status on the survival of CF populations from different countries around the world showed that it is of variable effect (**Table-1**) [14,16-23].

Objectives

To present the demographic data of CF patients and their families, which involves their social status and education.

Methodology

Retrospective Chart Review of all CF patients referred to CF clinic during the period from January 1998 to December 2018. Data on demographic, laboratory, educational, Employment, and social status levels of all CF patients and their parents were presented.

Definitions:

A patient with CF disease is defined as:

1. One who has typical pulmonary manifestations and/or typical gastrointestinal manifestations (GI) and/or a history of cystic fibrosis in the

immediate family in addition to sweat chloride concentration >60 mmol/liter.

2. Pathologic CFTR mutations on both alleles.
3. One who has typical pulmonary and manifestations and borderline or normal sweat chloride (CL) level (30-60 mmol/L) and or pathologic CFTR mutations on both alleles.

Table-1: Literature Review of Demographic Data of Cystic Fibrosis Worldwide

Ref	Country or Region	Study Design, Results, & Comments
1	Middle East	Systematic Review, 1:2500 live births in Jordan, 1:5000 live births in Bahrain, Median survival age at 10-20 years, consanguinity- 50% in general, 85% in CF families
4	United Arab Emirates	Pilot study to determine prevalence; 400 UAE nationals, 26 CF patients, P=1:15,876
5	Asia	CF epidemiology between 1960 and 2015, I=1:350,000 live births in Japan; 1:9200 Asian immigrants in Canada, 1:10,000 in the UK, 1:40,000 in the US
8	Europe (27 countries)	P= 0.737: 10,000. 35,806 CF patients in a total population of 486,114,000
9	International	53 national CF registries between 2008 and 2011, In non-EU countries, lower median age and poor survival rates
10	Europe (35 countries)	CF demographics and CFTR genotype data, In non-EU countries, higher infant mortality, More common in males
11	European Union	Cross-sectional study using data gathered for 29,025 patients, Median age in EU countries (17 years) older than in non-EU countries (12 years); Patients older than 40 years were 5% in EU and 2% in non-EU countries.
12	International	Literature Review, Median survival 25 years for F and 30 years for M
16	England and Wales	Cross-sectional study of annual deaths related to CF from 1959 to 2008, Median age at death higher in M more F, (25-29 yrs for M, 20-24 for F), Low SES is associated with greater disease morbidity and mortality in CF.
16	Australia	Cross-sectional Analysis, 2986 CF patients 48% F. median age at death was 27.9 for M and 25.3 for F
17	USA	Cross-sectional study of 22,714 CF patients, 1:2986 births. 6.65% Hispanic (1511 CF patients), Early diagnosis=prevalent among Hispanic patients.
14	USA	Historical Cohort 1986 to 1994, Disease severity correlated with SES.
18	Canada	1993 to 2002 of 1,174 participants, Higher income = better PFT
19	USA	Retrospective cohort of 23,817 CF, 44% increased risk for death for low-income groups (<$20,000) compared to high-income groups (>$50,000)
15	USA	Literature Review, Maternal college education, annual income >$50,000, were independently correlated with better treatment adherence
20	USA	a cohort of 1375 CF patients, 24.8% exposed to maternal smoking after birth, more prevalent in low SES families, Maternal education at high school or less in 28.1%. 26.8% have an annual household income of <$40,000. 43.8% without insurance or Medicaid, Low SES and smoke exposure had independent adverse effects on PFT and nutritional outcomes.
21	USA	12,822 patients diagnosed 1986 and 2000, Early diagnosis by neonatal screening leads to lower prevalence of RTIs
22	USA	Cross-sectional on 4,571 patients and 1,826 parents, Worse emotional and social functioning among African-American and Hispanic patients correlated with clinical outcomes.
23	Germany	Case-control study, Quality of Life reported to be worse among CF women. Depression increased as lung function declined.

Ref = References, P = Prevalence, I = Incidence, RTI = Respiratory tract infection, SES = Socioeconomic status, M = Males, F = Females, EU = European, PFT = Pulmonary function test, USA = United States of America

Ethical considerations and Statistical Method:

After obtaining the ethical approval by the research advisory committee (or institutional review board, IRB). The Declaration of Helsinki and good clinical practice guidelines were followed. Data collection and data entry were supervised by the principal investigator. All data needed were obtained by retrospective chart review and were stored in a pediatrics research unit, accessed only by the principle investigator and the assigned Clinical Research Coordinator. The entire patient's information kept strictly confidential. Each patient was given a study number, and all patients' data were entered into the designated data sheet (EXCEL) without any patient's identification. The department of Biostatistics Epidemiology and Scientific Computing (BESC) carried out statistical analysis of the data. The frequency of events was obtained by mean (SD), with simple descriptive analysis.

Results

A total of 430 confirmed CF patients. 236 (96%) patients survived, and 10 (4%) died. 213 (49.5%) were males, and 217 (50.5%) were females. 83% consanguinity rate. 45% had a family history of CF, and the diagnosis was suggested by family history in 9.5% of patients. 415 (98.1%) were of Saudi nationality. 156 (36.5%) were from the Eastern province. The mean age at diagnosis was 3.46 years (5.5) which is improved compared to a previous study in 1998 (3.46 ±5.5 years VS 33 ± 40 months), which could be explained due to the increasing CF diagnosis during adult age groups (26-28). Mean Sweat chloride was 92.04 mmol/ L (17.343). In reviewing the educational level of 247 patients, the level of elementary school accounted for 90 (36.1%) of patients, 24 (9.7%) of mothers, and 21 (8.5%) of fathers (**Table-2**). Similarly, 43 (17.3%)/ 22 (8.9%)/ 102 (41.3%) were in the preparatory level, 35 (14.1%)/ 43 (17.4%)/ 51 (20.6%) were in the high school level, and 23 (9.2%)/ 39 (15.8%)/ 46 (18.6%) were in the college level, respectively (**Table-2**). Regarding the employment: 145 (58.7%) patients are students, 3 (1.2%) are part-time employees, and 15 (6.0%) are full time employees. 207 (83.8%) mothers are housewives, 2 (0.8%) are students, and 29 (11.7%) have full time employment (**Table-3**). Paternal employment showed that 210 (85.0%) are full time, and 7 (2.8%) are part-time employees (**Table-3**). Regarding their accommodation: 77 (31.2%) of CF parents owned a villa, 81 (32.8%) rented an apartment, and 79 (32%) owned their own apartment (**Table-4**). The median survival around 22 years compared to 8 years in 1984 (**Fig-1**).

Table-2: Educational Level [Total 247 Patients]

Variable	Patients		Mothers		Fathers	
	Number	Percent	Number	Percent	Number	Percent
Elementary	90	36.4	24	9.7	21	8.5
Preparatory	43	17.4	22	8.9	102	41.3
High School	35	14.3	43	17.4	51	20.6
College/Higher	23	9.3	39	15.8	46	18.6
Illiterate	11	4.4	22	8.9	26	10.5
Unknown	45	18.2	97	39.3	1	0.4
Total	247	100	247	100	247	100

Table-3: Employment Status [Total 247 Patients]

Variable	Patients		Mothers		Fathers	
	Number	Percent	Number	Percent	Number	Percent
Full Time	15	6	29	11.7	210	85
Part Time	3	1.2	0	0	7	2.8
Student	145	58.7	2	0.8	0	0
Unemployed	47	19	4	1.6	23	9.3
Housewife	1	0.4	207	83.8	-	-
Unknown	36	14.7	5	2	7	2.8
Total	247	100	247	100	247	100

Table-4: Demographic Data [Total=430 patients]

Demographic		Number	Percent
Gender Total = 430	Male	213	49.5
	Female	217	50.5
Nationality Total = 423	Saudi	415	98.1
	Non-Saudi	8	1.9
Race Total = 425	White	2	0.5
	Arabian	422	99.3
	Asian	1	0.2
Country of Origin Total = 428	KSA	421	98.4
	Other	7	1.6
Region of KSA Total = 427	East	156	36.5
	West	77	18
	Central	100	23.4
	North	52	12.2
	South	42	9.8
Accommodation Type Total = 247	Owned Apartment	79	32
	Owned Villa	77	31.2
	Rental Apartment	81	32.8
	Rental Villa	7	2.8
	Other	3	1.2
Consanguinity Total = 242	First Cousin	109	45
	Any Relation	92	38
	Unrelated	41	16.9
Family History of CF Total = 238	Yes	107	45
	No	131	55
Dx Suggested by FHx Total = 430	No	389	90.5
	Yes	41	9.5

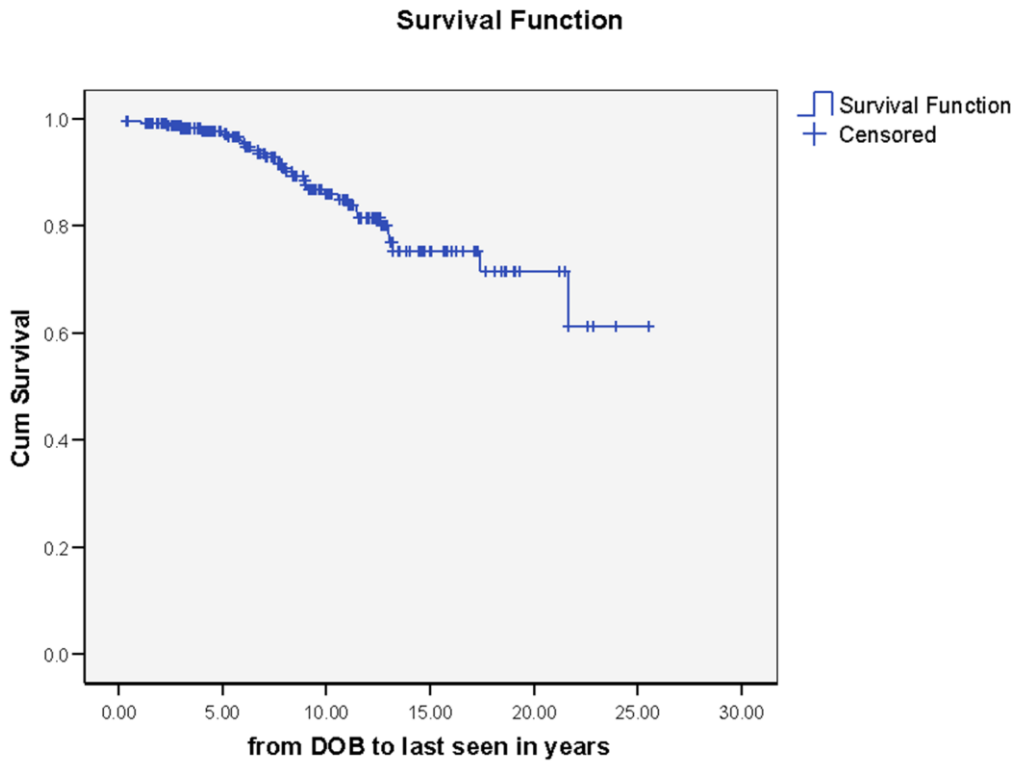

Fig: Median Survival of CF population in KSA (430 patients)

Legend Figure :

Cum- cumulative

DOB- date of birth

KSA= Kingdom of Saudi Arabia

Discussion

Our findings showed consistently similar results in all demographic data as the previous report from our center with a smaller CF population [24] as the following: more females have CF than males; however, the difference was not significant. The majority of patients are Arabian, predominantly Saudi citizens residing in the Eastern province [25,26]. The mean age at CF diagnosis has increased compared to a previous study in 1998 (3.46 ±5.5 years VS 33 ± 40 months), which could be explained due to the increasing CF diagnosis during adult age groups [25-26]. The median survival of 22 years is markedly improved compared to 8 years in 1984 as per our registry data (**Fig-1**) [1,25,26]. This finding indicates the improvement in medical care and the awareness improvement of physicians and medical staff.

The majority of patients are at the elementary school which leaves the patients almost entirely dependent on both parents for their care and fully dependent on their fathers alone for financial support. The majority of patients have the security of owning their accommodation; however, it can also call to question the relevance of conditions of their accommodation – location, climate, hygiene, etc. – which would require a further inquiry to better understand patients' lifestyles.

Further efforts need to be applied to different aspects of care to improve survival to match other European or North American countries of 45-50 years [1,27,28]. Factors that need to be improved include Early diagnosis and referral to experienced centers, compliance of taking medications, chest physiotherapy, early Nutritional rehabilitation, and proper genetic counseling [1].

Conclusion

More than 2/3 of CF patients are students at the

elementary school level, and only 6.0% have a full-time job, which makes them completely dependent on both parents for their care. Median survival improved from 8 years in 1984 to 22 years. More efforts need to be applied to different aspects of care to further improve median survival to parallel that of the European or North American data.

Acknowledgment

None

Conflict of Interest

All authors have read and approved the final version of the manuscript. The authors have no conflicts of interest to declare.

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