

Trends and Determinants Among Cardiac Disabled Workers in Alexandria

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Abstract: Background: The present study was designed to investigate the trend and determinant factors among cardiac disabled workers presented in the years 2003-2005 at Health Insurance Committee for disability rating in Alexandria and to compare the currently used system with others. **Methods:** A retrospective study was conducted to review complete records for those below the age 65 years. The available data were coded to include age, gender, job title, disabling symptoms, presence or absence of abnormal findings in resting electrocardiogram and chest X-ray. Extra-investigations were considered by the committee in some cases including echocardiography, cardiac stress test and coronary angiography. Therapeutic interventions were coded and etiological diagnosis was classified into ischemic heart disease (IHD), rheumatic heart disease (RHD), hypertension (HT) and cardiomyopathies (CM). The functional diagnosis was reported as presence or absence of heart failure and disability was rated as partial or total. **Results:** The results revealed that rates of disabling dyspnoea, CM and heart failure were significantly increasing from year to year ($p=0.038$, 0.039 & 0.023 respectively). The most common etiological diagnosis for the presented cases was IHD with high rates ranging from 69.7% to 73.6% across the 3 years. Logistic regression with total disability as the dependent variable showed that heart failure and additional information by echocardiography were the independent determinants ($p= 0.020$ & 0.004 respectively). Simplified comparison between current cardiac disability rating system and American medical Association impairment classification was given. **Conclusion:** The present disability rating system lack standardization and quantification. It is recommended to integrate the metabolic equivalent (METs) measurement with the current system and to emphasize cardiovascular preventive programs to control cardiac disability.

INTRODUCTION:

There is a global observation of increasing burden of cardiovascular diseases especially in developing countries. Although, cardiovascular mortality is still high, yet it witnessed some reduction due to preventive efforts and possibly due to improvement in management. However, the cardiovascular disability with its economic and social cost is increasing.⁽¹⁾ Cardiac disability rating is frequently

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requested since workers' compensation laws provide benefits for permanent disability if a person is restricted or excluded from the job market because of limited function.⁽²⁾ The Egyptian social insurance law 79/1975, subject 78 is clarifying this issue as regards to patients with chronic disabling diseases including cardiac cases.⁽³⁾ This is applied for cardiac disabled workers whether due to occupational or non-occupational etiology. The difference will be in the system of compensation. Also, cases of partial limitations will get a chance for job change in situations of mismatched patient's functional capacity and job demands. Therefore, the nature of work whether is it mental or physical may influence the disability rating decision.⁽⁴⁾

Cardiac impairment evaluation is challenging since it involves an often difficult assessment of subjective complaints as well as objective diagnostic modalities. It is lacking consistent basis,

with varying medical evidence used by the different examiners in the same case.⁽⁵⁾ The Egyptian guidelines for cardiac disability rating is based mainly on clinical assessment of the case and is attached to the law 25/1977.⁽³⁾ The etiological diagnosis of cardiac disability might contribute to the rating variance. Ischemic heart disease (IHD), rheumatic heart disease (RHD), hypertension (HT) and cardiomyopathies (CM) are the most frequently presenting cases.⁽⁶⁾

This study was designed to investigate the trends of cardiac disabled workers according to their clinical presentation through the years 2003-2005 in Alexandria. Also, to study the most important determinants for cardiac disability rating among them. This is to compare between the current rating system and others, in order to suggest suitable modifications.

Material and Methods

Study setting: Records of cardiac disability cases presented to the Health

Insurance Committee for disability rating in Alexandria through the years 2003-2005.

Study design: Retrospective study.

Study Population: Cases presented seeking rating of cardiac disability and fulfilling legislative justification of 2 years full payment decision or medical indication approved by the committee were selected.⁽³⁾ The pre-requisites of presentation are:

- Provisional clinical assessment by Health Insurance cardiologist.
- Record of frequent hospital admissions and sick leaves due to cardiovascular disease.
- Recent resting electrocardiogram (ECG) and plain chest X-ray (CXR) postero-anterior view.
- Reports of recent extra-investigations done by health insurance hospitals.
- Reports about therapeutic interventions done.
- Job description to define job title and occupational performance needs.

All cases with complete data and below the age of 65 years, to involve both general and private sector cases before pension, were included in the study.

Methods

Research teams of post graduate physicians in the Department of Occupation Health, High Institute of Public Health, Alexandria University were trained to review cardiac disability records and to define the available data into variables. Then, variables were coded to include age in years and gender. Type of work was classified according to the Dictionary of Occupational titles ⁽⁷⁾ into blue-collar and white-collar jobs with their categories. The presenting disabling symptoms were considered as dyspnoea and/or anginal pain if they were class 3 (occurring during ordinary physical activity) or class 4 (occurring at rest and worse with any physical activity) according to the New York Heart Association (NYHA) functional classification of cardiac disease.⁽⁸⁾

Resting ECG and CXR findings were coded as normal or abnormal according to judgment by the Committee. The extra-investigation; such as echocardiography, cardiac stress testing and coronary angiography; that were presented by cases either upon request of the committee or recently done in the course of management of the disease to clarify diagnosis and/or functional status were reported as considered or not by the committee to influence decision. The therapeutic interventions reported in cases are percutaneous interventions (PCI) with angioplasty or stenting, coronary artery bypass grafting (CABG) and valve replacement (VR). The etiological diagnosis of presented cases was classified as IHD, RHD, HT and CM. The functional diagnosis was assessed by the committee and reported as presence or absence of heart failure. Finally, the cardiac disability was rated as partial or total as related to whole person impairment

(WPI).

Statistical Analysis:

Data was entered and analyzed using SPSS (Statistical package for social sciences) version 11.⁽⁹⁾ Comparisons of qualitative variables across the three years was done by Z test and between 2 groups was done by X² test. Logistic regression analysis was done with total disability as the dependent variable to examine for its independent determinants among significant variables in univariate analysis. Continuous variables were expressed as means and standard deviations and compared by t-test. The level of significance for p value was considered at 0.05.

RESULTS

The mean age of the studied population in the years 2003-2005 were 50.3 ±7.79, 50.7±6.39 and 49.6±7.41 years respectively without significant differences. The included number of cases presented yearly in this period were 704, 876 and

1127 cases respectively. The presented blue collar workers included unskilled, semiskilled and skilled workers ranging from 70.8% to 79.6% of total cases across the 3 years without significant differences. Meanwhile, the presented white collar workers were professionals, clericals and owners with decreasing rate from 29.2% to 20.4% of total cases across the 3 years, but without significant differences. (Table 1)

Male workers represented almost 80% of the studied population versus 20% for female workers across the 3 years. Dyspnoea as the disabling presenting symptom showed a statistically significant difference of increase from year to year ($p=0.038$). On the other hand, disabling anginal pain showed a statistically significant difference of decrease from year to year ($p=0.033$). Some cases presented with both symptoms simultaneously. (Table 2)

Abnormal findings in resting ECG among presented cases were decreased with statistical significance from year to

year ($p=0.044$). Meanwhile, the rates of abnormal CXR findings ranged between 46.0% to 51.0% of total yearly cases with statistically insignificant difference. The extra-investigations that were considered by the committee as helpful in disability rating of some cases were echocardiographic examination, cardiac stress testing and coronary angiography, with statistically significant differences of increase from year to year for all of them ($p=0.0001$, 0.0023 & 0.012 respectively). (Table 3)

The etiological diagnosis of most of the presented cases was IHD ranging from 69.7% to 73.6% of total yearly cases without significant difference. Also no significant differences across the 3 years for the rates of presented RHD and HT; meanwhile, cardiomyopathies were significantly increasing ($p=0.039$). On the other hand, it was observed that no significant changes for the yearly rates of interventions performed for presented

cases, except for the rate of combined PCI and CABG that was significantly increasing yearly ($p=0.048$). (Table 4)

It was found that presence of heart failure as the functional diagnosis reported by the committee was significantly increasing from 34.1% to 56.3% of total yearly cases ($p=0.023$). However, no significant difference across the 3 years for rating disability as total, which ranged from 33.8% to 39.9% of total cases. (Table 5)

Comparison between partially and totally disabled workers according to the studied variables in all the presented population (2003-2005) revealed significantly higher rates of consideration of echocardiography and diagnosis of heart failure among totally disabled than partially disabled workers ($p=0.027$ & 0.033 respectively). Meanwhile, partially disabled workers had more consideration of cardiac

stress test and diagnosis of IHD than totally disabled cases ($p=0.021$ & 0.012 respectively). (Table 6) In multiple logistic regression analysis with total disability as the dependent variable, presence of heart failure and consideration of echocardiography were the independent determinant factors ($p=0.02$ & 0.004 respectively). (Table 7)

Table 8 illustrates impairment classification for cardiac diseases in Egypt (section A) and American Medical Association (AMA) system (section B). It shows that our currently used classification is based mainly on clinical assessment and some subjective measures; meanwhile, the AMA system is based mainly on standardized measurement of maximally achieved metabolic equivalent units (METs) beside other clinical parameters.

Table (1): Distribution of the studied population according to their occupation by the year of presentation.

Occupation	2003		2004		2005		Total		p
	no.	%	no.	%	no.	%	no.	%	
Blue collar workers									
-Unskilled	79	11.2	102	11.6	152	13.5	333	12.3	
-Semiskilled	203	28.8	260	29.8	381	33.8	844	31.2	
-Skilled	217	30.8	286	32.6	364	32.3	867	32.0	
Total	499	70.8	648	74.0	897	79.6	2044	75.5	>0.05
White collar workers									
-Professionals	55	7.8	68	7.8	71	6.3	194	7.2	
-Clericals	102	14.6	108	12.3	111	9.8	321	11.8	
-Owners	48	6.8	52	5.9	48	4.3	148	5.5	
Total	205	29.2	228	26.0	230	20.4	663	24.5	>0.05
Grand total	704	100.0	876	100.0	1127	100.0	2707	100.0	

Table 2: Gender and disabling symptoms of the studied population

		2003		2004		2005		p
		no. (n=704)	%	no. (n=876)	%	no. (n=1127)	%	
Gender	Men	562	79.8	692	79.0	897	79.6	>0.05
	Women	142	20.2	184	21.0	230	20.4	
Dyspnea	Yes	248	35.2	370	42.2	601	53.3	0.038
	No	456	64.8	506	57.8	526	46.7	
Anginal pain	Yes	554*	78.7	573**	65.4	586***	52.0	0.033
	No	150	11.3	303	34.6	541	48.0	

*98 cases have both dyspnea and anginal pain 13.9%

** 67 cases have both dyspnea and anginal pain 7.6%

*** 60 cases have both dyspnea and anginal pain 5.3%

Table 3: Significant findings in resting ECG and chest X-ray, and the considered extra-investigations among the studied population.

		2003		2004		2005		p
		no. (n=704)	%	no. (n=876)	%	no. (n=1127)	%	
ECG	Abnormal	690	98.0	816	93.2	926	82.2	0.044
	Normal	14	2.0	60	6.8	201	17.8	
CXR	Abnormal	324	46.0	394	45.0	575	51.0	>0.05
	Normal	380	54.0	482	55.0	552	49.0	
Echo-cardiography	Considered	98	13.9	320	36.5	910	80.7	0.0001
	Not	606	86.1	556	63.5	217	19.3	
Cardiac Stress test	Considered	38	5.4	116	13.2	320	28.4	0.0023
	Not	666	94.6	760	86.8	807	71.6	
Coronary angiography	Considered	82	11.6	184	21.0	372	33.0	0.012
	Not	622	88.4	692	79.0	755	67.0	

Table 4: Etiological diagnosis and interventions reported among the studied population.

	2003		2004		2005		p
	no. (n=704)	%	no. (n=876)	%	no. (n=1127)	%	
Etiological diagnosis							
-IHD	491	69.7	639	72.9	830	73.6	>0.05
-RHD	149	17.0	131	15.0	135	12.0	>0.05
-HT	26	2.3	21	2.4	50	4.4	>0.05
-Cardiomyopathies	38	4.0	85	9.7	112	10.0	0.039
Interventions reported							
-PCI	14	2.0	37	4.2	59	5.2	>0.05
-CABG	63	8.9	103	11.8	128	11.4	>0.05
-PCI+CABG	9	1.3	23	2.7	46	4.1	0.048
-VR	28	4.0	39	4.5	42	3.7	>0.05

Table 5: Functional diagnosis and disability rating among the studied population

	2003		2004		2005		p
	no. (n=704)	%	no. (n=876)	%	no. (n=1127)	%	
Heart Failure							
Yes	240	34.1	359	41.0	635	56.3	0.023
No	464	65.9	517	59.0	492	43.7	
Disability rating							
Partial	466	66.2	555	63.4	677	60.1	>0.05
Total	238	33.8	321	36.6	450	39.9	

Table 6: Comparison between partial and total disabled cases according to the studied variables in all presented population (2003-2005)

	Partial (n=1698)		Total (n=1009)		P
	no.	%	no.	%	
Male workers (n=2151)	1283	59.6	868	40.4	>0.05
Blue collar workers (n=2044)	1210	59.2	834	40.8	>0.05
Presence of dyspnea (n=1219)	566	46.4	653	53.6	>0.05
Presence of anginal pain (n=1713)	815	47.6	898	52.4	>0.05
Significant resting ECG (n=2432)	1430	58.8	1002	41.2	>0.05
Significant CXR (n=1293)	632	48.9	661	51.1	>0.05
Considered echocardiography (n=1328)	584	44.0	744	56.0	0.027
Considered cardiac stress test (n=474)	313	66.0	161	34.0	0.021
Considered coronary angiography (n=638)	324	50.8	314	49.2	>0.05
Cases of IHD (n=1960)	1406	71.7	554	28.3	0.012
Cases with heart failure (n=1234)	388	31.4	846	68.6	0.033

Table 7: Multiple logistic regression analysis with total disability as the dependent variable

	Unstandardized Coefficients		Standardized Coefficients	t	p
	B	Std. Error	Beta		
(Constant)	.886	1.413		.627	.031
Presence of heart failure	.376	.160	.200	2.346	.020
Considered Echocardiography	1.114	.386	.244	2.886	.004
Considered stress test	1.066	1.372	.050	.777	.438
Cases with IHD	.473	.255	.121	1.856	.065

Table 8: Impairment classification for cardiac diseases**Section A: Egyptian table ⁽³⁾**

Mild 10 – 20 % WPI	Moderate 20 – 60 % WPI	Severe 80% WPI
<ul style="list-style-type: none"> ▪ No or Equivocal Symptoms ▪ Documented heart disease including coronary artery disease, valvular diseases, cardiomyopathies and adhesive pericarditis ▪ Compensated heart 	<ul style="list-style-type: none"> ▪ Some cardiovascular symptoms ▪ Documented heart disease by clinical examination , investigations and reports ▪ Relatively Compensated heart 	<ul style="list-style-type: none"> ▪ Frequent cardiovascular symptoms ▪ Documented heart disease ▪ Severely Decompensated heart

Section B: AMA Table ⁽⁸⁾

Class I 0–9%WPI	Class II 10-29%WPI	Class III 30–49 %WPI	Class IV 50-100%WPI
<ul style="list-style-type: none"> • Equivocal cardiovascular complaints • CV disease proved at early or at subclinical phase • METS determination is not applicable 	<ul style="list-style-type: none"> • Symptoms on heavy physical exertion • Documented Heart disease by investigations or cardiac surgery • Achieve > 7 METS or 90% of predicted maximum heart rate 	<ul style="list-style-type: none"> • Frequent symptoms on moderate physical exertion that need medication for control • Documented heart disease • Achieve 7-5 METS 	<ul style="list-style-type: none"> • Symptoms on ordinary physical activity or at rest requiring medication • Documented heart disease • Achieve < 5 METS

DISCUSION

Cardiac disabled workers are increasing. The present study showed significant trends for increase in dyspnoea, cardiomyopathies and heart failure among cardiac disabled cases during the years of

study. On the other hand, anginal pain was found to decrease, although the most common etiological diagnosis for the presented cases was IHD, possibly due to introduction of new effective drugs. It was also observed that aggressive intervention

combining both PCI and CABG was increasing. Of course, this is very expensive and is increasing the economic burden on health services. If these trends are going to continue uncontrolled serious community problems are expected. These findings should be taken into consideration in budget planning for health and social services.

The importance of the current study is the presence of scarce reports addressing the problem of cardiac disability. Review of a community register from London indicates that the new pharmacologic agents and interventions for heart disease may reduce mortality. However, the cardiac disability sequelae is increasing in many instances since treatment will slow down the disease process but not stopping it.⁽¹⁰⁾ Therefore, prevention of heart disease at a very early phase and control of risk factors are the best strategies to decrease trends of cardiac disability and to prevent heart failure.

Based on the current data, resting ECG as a tool for assessment of cardiac impairment is significantly decreasing. This is possibly attributable to the fact that many serious cardiac diseases may occur without abnormal resting ECG changes. On the other hand, consideration of more recent informative investigations is significantly increasing. Echocardiography was considered as helpful in assessment of cardiac impairment in about 81% of cases presented in the last year of study. However, cardiac stress test and coronary angiography were considered helpful in only about 28% and 33% of cases respectively in the last year of study. These figures are reasonable for coronary angiography, but too low for cardiac stress testing which is an important non-invasive economic tool in occupational cardiology.⁽¹¹⁾

The rating system for cardiac disability that was adopted in the current setting depends mainly on clinical assessment, the

integrated information from the different investigations and finally the experienced opinion of the committee with its members in both fields of cardiology and occupational health. The rating of disability was given after answering four questions within the frame of the given guidelines⁽³⁾ listed in section A of table 8:

- How much disabling cardiovascular symptoms were reported by the case?
- What cardiac disease has this patient? as proved by investigations and reports.
- What is the degree of irreversible (permanent) cardiac de-compensation in this case?
- Could this patient with his residual capacities perform his original job asks in-full, partly or not at all.?

The final rating decision was given as two categories either partial or total disability. Cases with mild or moderate cardiac impairment were rated as partial disability; meanwhile, those with severe

cardiac impairment were rated as total disability. Multivariate analysis of the current data revealed that clinical diagnosis of heart failure and the additional information by echocardiography were the independent determinants for disability rating of cases. These results sound reasonable; however, precision and quantification is lacking. Also experience and personal opinion may play an important role subjecting decisions to variability and poor standardization.

The western systems adopted different methods for rating of disability in cardiac workers.^(2,4,8,12) Most of the methods depend on quantification of cardiac disability in metabolic units called METs. Each MET represents 3.5 cc of oxygen consumption per kilogram per minute. One MET equals oxygen uptake at rest.⁽¹³⁾ Treadmill exercise time can be used simply to predict the maximum oxygen consumption (VO_2 max) in METs either by direct computer display or from the

available tables for men and women according to the type of exercise protocol.⁽⁴⁾ This is an integral part of cardiac stress testing that should be done according to the standard methods⁽¹⁴⁾ in every stable possible case. This test will add three dimensions for precision:

- Verification of symptoms and diagnosis by an objective method.
- Assessment of possible reversibility of impairment.
- Quantification of permanent impairment and calculation of permitted physical performance level.

The American Medical Association (AMA)⁽⁸⁾ impairment classification was selected as a reasonable reference for comparison. This system is based on both subjective and objective measures and is given in section B of table 8. This classification is different from NYHA functional classification of cardiac disease. AMA impairment classification in classes 2 to 4 is depending on maximum peak MET

level achieved during testing. Each class gives a range of whole person impairment (WPI).

The percent disability within the determined class is given by evaluating how much is he or she limited from the required job tasks as well as everyday activities. The MET levels of the different work activities are available in tables ranging from >6 METs for heavy activity to <2 METs for sedentary work.⁽⁵⁾ The work MET level of the original job of the presenting case is compared to 40% of the actual maximum MET level achieved during impairment assessment. This is because a work MET level is based on an eight-hour work activity. The difference would suggest the disability rate within the spectrum of impairment class, whether to take a lower or a higher value.

The use of the previously simplified AMA impairment system needs to ensure permanent injury of the patient by comparing current MET level with previous

exercise testing or with the translated immediate long term activity into METs. For severely disabled cases and in whom exercise testing is difficult, ejection fraction by echocardiography or by any other mean is calculated. A measurement of more than 50% is considered normal, between 45% and 50% mild impairment, between 30% and 45% moderate impairment, between 20% and 30% severe impairment, and below 20% total disability.^(2,15)

Comparison between Egyptian and AMA systems reveals that classes 2 to 4 of the later is very near to our current system apart from application of the objective METs values that would improve assessment standards of the current disability rating system in cardiac patients.

CONCLUSION AND RECOMMENDATIONS

The present disability rating system lacks standardization and quantification. It is recommended to integrate the METs measurement with the current system. Also to emphasize cardiovascular preventive

programs to control cardiac disability,

- The increasing rates of cardiac disability should be considered as a priority area for social care and health preventive efforts among the productive sector of the community.
- Control of cardiovascular risk factors and early diagnosis of cardiac disease during periodic medical checkups is highly recommended especially for those above the age of 45 years.
- Integration of the METs level measurement with the currently used system for disability rating in cardiac patients will contribute positively for standardization and quantification of its determinants.

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