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Non-cardiovascular co-morbidity in elderly patients with heart failure outnumbers cardiovascular co-morbidity

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Received 18 April 2006; received in revised form 7 November 2006; accepted 19 February 2007

Available online 28 March 2007

Abstract

Background: Patients with heart failure often suffer from multiple co-morbid conditions. However, until now only cardiovascular co-morbidity has been well described.

Aims: To understand heart failure in the context of multi-morbidity, by describing the age and sex specific patterns of non-cardiovascular co-morbidity in elderly patients with heart failure in general practice.

Methods: All patients aged 65 years and over, diagnosed with heart failure in four practices of the Nijmegen Academic Practice-based Research Network (NPBRN) between January 1999 and December 2003 were selected, and the prevalence of 27 cardio- and non-cardiovascular co-morbidities determined.

Results: Of the 269 patients identified (mean age 79 years; 57% women), 80.2% had four or more co-morbidities. With increasing age, a significant increase in the prevalence of non-cardiovascular conditions like visual and hearing impairments, osteoarthritis, dementia and urine incontinence; and a decrease in cardiovascular conditions like myocardial infarction and in women, hypertension, was observed. In patients aged 85 years and over, non-cardiovascular disorders predominated over cardiovascular disorders.

Conclusions: In elderly patients with heart failure, the prevalence of non-cardiovascular co-morbidity is very high and exceeds the prevalence of cardiovascular conditions. Diseases such as dementia and osteoarthritis must be taken into account in the management of elderly patients with heart failure.

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Keywords: Heart failure; Elderly; Co-morbidity; Non-cardiovascular; General practice

1. Introduction

Heart failure has become a very prevalent health condition in elderly patients. Recent studies of the population prevalence of heart failure in the UK and The Netherlands have reported a prevalence of between 7.1 and 8.3 per 1000

persons, increasing with age, from 90 per 1000 in patients aged 65–74 years, up to 174 per 1000 patients aged 85 years and over [1–3]. Consequently, diagnosis and management of heart failure consumes approximately 2% of the national health care budgets of most industrialized countries [4], the majority being spent on elderly patients aged 65 years and older [5].

One of the major characteristics of elderly patients is the presence of multi-morbidity [6,7]. Since the average age at heart failure diagnosis is 80 years, most patients with heart failure will therefore suffer from multiple health conditions [8]. A substantial part of these co-morbid health conditions will be age-related, non-cardiovascular disorders.

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Although the importance of co-morbidity is recognised, there is a paucity of empirical data on the diagnosis and management of heart failure in the presence of co-morbidity. Available data are directed predominantly at underlying causative cardiovascular conditions [9]. However, with the ageing of the heart failure population, the presence of age-related, non-cardiovascular co-morbidity has become increasingly relevant. Co-morbidity may interfere with the diagnosis and treatment of heart failure or resulting health gains and quality of life. In the same way, heart failure may influence the diagnosis and treatment of concomitant disorders [10].

The frequency of some non-cardiovascular co-morbidities in hospital and nursing home populations has been reported [11,12] and two studies have demonstrated the negative influence of non-cardiovascular co-morbidities on patient outcomes [5,13]. Recently, Dahlström described four, prevalent non-cardiac co-morbidities (hypertension, diabetes mellitus, COPD and anaemia) in terms of epidemiology, mechanisms linked to heart failure, treatment and prognosis [14]. The author concluded that early detection of concomitant diseases in patients with heart failure is important and should be considered when initiating therapy.

To support this early detection, better insight into the occurrence of co-morbidity in elderly patients with heart failure is essential. To our knowledge no previous study has comprehensively reported on the prevalence of (non-cardiovascular) co-morbidity in a general population of elderly patients with heart failure.

The aim of this study was therefore, to describe the prevalence of cardiovascular and non-cardiovascular health conditions in patients, aged 65 years and older with heart failure in general practice and to relate this to their demographic characteristics.

2. Methods

2.1. Database and population

We extracted data from the Continuous Morbidity Registration (CMR). This database contains data from 4 general practices which are part of the Nijmegen academic Practice-Based Research Network (NPBRN), in the Netherlands. The practices are fully computerized and have approximately 14,000 patients listed with a sex and age distribution representative of the Dutch population. The database is particularly suitable for studying longitudinal data and tracking morbidity. Since 1971 ongoing, all episodes of morbidity presented to the general practitioner, diagnoses made by specialists after referral, and cause of death are registered with the use of the diagnostic criteria of the International Classification of Health Problems in Primary Care (ICHPPC)-2-defined [15–17]. These diagnostic criteria are also used in the Guidelines of the Dutch College of General Practitioners, including the Guideline for heart failure [18]. The quality of the data is maintained by

regular instruction and training sessions on diagnosis and coding and by quality control measures [19]. If a diagnosis turns out to be incorrect, correction to the appropriate diagnostic code will be made at the start of the episode and the date of first presentation. For this study we selected all patients aged 65 years and over, with a record of “heart failure” between 01-01-1999 and 31-12-2003.

2.2. Heart failure and co-morbidity

The diagnosis “heart failure” was based on the criteria of the first edition (1995) of the guideline “Heart failure” of the Dutch College of General Practitioners [18]. In this edition, heart failure was not defined according to the *current* criteria for heart failure as set by the European Society of Cardiology [20]. The use of echocardiography was not actively advocated and the diagnosis was made based on history, physical examination and additional investigations (ECG, chest X-ray). The diagnosis was made in adults with exertional breathlessness and/or reduced exercise tolerance due to breathlessness or fatigue and one or more of the following: paroxysmal nocturnal breathlessness or orthopnoea; pulmonary basal crepitations; raised jugular venous pressure; third heart sound; chest X-ray with heart–thorax ratio >0.50 or interstitial pulmonary oedema or venous redistribution; history of ejection fraction <0.4. In addition, signs and symptoms to support the diagnosis were described: history of relevant cardiovascular disease; tachycardia or irregular pulse; heart murmur; peripheral oedema and palpable liver.

In order to substantiate the validity of the diagnosis in our studied population, we retrospectively analyzed data of a random selection of 100 patients. We reviewed the medical files on the diagnostic process applied by the general practitioner, including the results of any referrals to a cardiologist. The diagnosis of heart failure was deemed to be valid when either the Walma score was positive or if the diagnosis was confirmed by a cardiologist [21].

Co-morbidity was defined as the coexistence of one or more health conditions in a patient with an index disease (in our study this was heart failure) [22]. Co-morbidity was assessed either at the date of diagnosis or at the date of cohort entry (01-01-1999) in case of known patients with heart failure. We selected co-morbidities based on an analysis of all chronic conditions present in the studied population. The 20 most prevalent conditions were chosen for further study (Table 1). We also defined 10 non-cardiovascular health conditions of *a priori* interest (rheumatoid arthritis, osteoarthritis, deafness, visual impairments, syncope, dizziness, dementia, depression, anaemia, and thyroid dysfunction). These conditions were included in our study, even if they were not in the top 20. Of the top 20, we excluded “conditions of eye; others” because of its obscure definition. In addition, we combined all types of osteoarthritis and combined cataract, glaucoma and blindness as “visual impairments”. All studied co-morbidities were defined

Table 1
Patient characteristics and the 20 most prevalent chronic health conditions in the study population

Variables	
Number of patients	269
Age distribution (n)	
65–74 years	75
75–84 years	124
85+ years	70
Mean age in years (SD)	79.2 (7.8)
Sex (%)	
Women	57.2
Men	42.8
Top 20 most prevalent chronic co-morbidities (%)	
Hypertension	37.5
Cataract	37.2
Varicose veins/CVI	37.2
Overweight (25 < QI ≤ 30)	33.8
Atrial fibrillation	32.3
Deafness	30.5
Diabetes mellitus	29
Osteoarthritis of knee	28.6
Angina Pectoris	27.9
TIA/CVA	25.7
Myocardial infarction	24.9
COPD	24.5
Obesity (QI > 30)	20.8
Valve disorders	18.2
Urine incontinence	17.5
Malignancies	16
Nervous functional	15.6
Osteoarthritis of hip	15.6
Conditions of eye; others	15.2
Lipid metabolism disorders	12.3

SD = Standard deviation; CVI = chronic venous insufficiency; TIA = Transient Ischaemic Attack; CVA = Cerebral Vascular Accident; COPD = Chronic Obstructive Pulmonary Disease.

according to the diagnostic criteria of the International Classification of Health Problems in Primary Care (ICHPCC)-2-defined [15–17].

2.3. Statistical analysis

Exact binomial distribution and the Poisson distribution were used to calculate 95% confidence intervals for the

prevalence and incidence (in person years) respectively. We used Maentel Haenszel Chi square tests to determine age trends in the whole study group and according to sex for changes in the prevalence of all studied co-morbidities. Differences in prevalent co-morbidity between the sexes per age group were determined using Chi square tests. Due to the explorative nature of our study corrections for multiple testing were not indicated. All statistical analyses were performed with SAS software version 9.1.

3. Results

In the CMR, 269 patients aged 65 years and over were registered as having heart failure, the characteristics of these patients are given in Table 1. In 150 patients heart failure had been diagnosed before 1999 and in the remaining 119 patients heart failure was diagnosed during the study period. In a random sample of 100 patients, 92% of all heart failure diagnoses were confirmed by either a positive Walma score and/or assessment by a cardiologist.

The selection of co-morbidities as described in the Methods section resulted in 27 health conditions to be studied. Three of the 10 conditions of *a priori* interest proved to be part of the top 20 most prevalent health conditions. In total, the studied health conditions made up over 70% of all recorded chronic conditions in the studied population.

The incidence and prevalence of heart failure increased substantially with age. The incidence increased from 0.7 (0.3–1.3) % in patients aged 65–74 years and 1.9 (1.2–3.0) % in patients aged 75–84 years to 4.7 (3.5–6.1) % in those aged 85 years and over. The prevalence increased from 3.3 (2.8–3.8) % and 13.1 (11.9–14.4) % to 26.2 (23.1–29.5) % respectively (95% CI in parentheses).

Table 2 denotes the age and sex specific distribution of the number of co-morbidities. At least one co-morbid condition was present in each patient. In patients aged 65 years and over four or more co-morbidities were present in 80.2% and six or more co-morbidities in 45.3%. The distribution of the number of co-morbidities differed between age groups; with advancing age the median number of co-morbidities increased.

Table 2
Sex and age specific number of co-morbidities (% of patients) in patients aged 65 years and over with heart failure

Age group (yrs)	Men			Women			Total		
	64–74	75–84	85+	65–74	75–84	85+	65–74	75–84	85+
	n=46	n=56	n=13	n=29	n=68	n=57	n=75	n=124	n=70
Co-morbidities									
0	0	0	0	0	0	0	0	0	0
1–3	32.6	19.6	0	27.6	16.2	14.0	30.1	17.7	11.4
4–5	30.4	39.3	61.5	37.9	27.9	35.1	33.3	33.1	40.0
6–7	28.3	28.6	23.1	24.1	26.5	35.1	26.7	27.4	32.9
>7	8.7	12.5	15.4	10.3	29.4	15.8	9.3	21.7	15.7

Percentages may not add up exactly to 100 because of rounding.

Table 3
Age and sex specific prevalence of co-morbidities in patients aged 65 years and over with heart failure

Co-morbidity	Men by age group			Women by age group			Men and women by age group		
	65–74	75–84	85+	65–74	75–84	85+	65–74	75–84	85+
	n=46	n=56	n=13	n=29	n=68	n=57	n=75	n=124	n=70
Anaemia	8.7	17.9	15.4	6.9	16.2	15.8	8	16.9	15.7
Angina pectoris	37	37.5	23.1	34.5	30.9	21.1	36	33.9	21.4
Atrium fibrillation or flutter	39.1	39.3	38.5	34.5	39.7	36.8	40	39.5	34.7
COPD	39.1	35.7	38.5	20.7	22.1	12.3	32	28.2	17.1 ^a
CVA or TIA	23.9	28.6	46.2	27.6	33.8	28.1	25.3	31.5	31.4
Dementia	0	12.5	15.4 ^a	3.4	7.4	22.8 ^a	1.3	9.7	21.4 ^a
Diabetes Mellitus	37	30.4	38.5	24.1	38.2	17.5	32	34.7	21.4
Hearing impairment	19.6	33.9	46.2 ^a	17.2	25	56.1 ^a	18.7	29	54.3 ^a
Hypertension	34.8	33.9 ^b	30.8	48.3	52.9 ^b	24.6 ^a	40	44.4	25.7
Lipid metabolism disorders	23.9	12.5	0 ^a	6.9	16.2	5.3	17.3	14.5	4.3 ^a
Malignancies	28.3	32.1	30.8	20.7	23.5	14	25.3	27.4	17.1
Myocardial infarction	41.3	41.1	15.4	20.7	29.4	14	33.3	34.7	14.3 ^a
Nervous Functional	21.7	19.6	30.7	34.5	30.9	18.8	26.7	25.8	28.6
Obesity (QI>30)	39.1	5.4 ^b	23.1	31	20.6 ^b	19.3	36	13.7	20 ^a
Osteoarthritis	40	41.1 ^b	61.5	37.9	57.4 ^b	70.2 ^a	37.3	50	68.6 ^a
Overweight	23.9	37.5	46.2	31	41.2	31.6	26.7	39.5	34.3
Thyroid dysfunction	0	1.8 ^b	0	13.8	16.2 ^b	14	5.3	9.7	11.4
Urine incontinence	2.2	14.3	23.1 ^a	24.1	20.6	47.4 ^a	10.7	17.7	42.9 ^a
Visual impairments	23.9	41.1	53.8 ^a	24.1	51.5	56.1 ^a	24	46.8	55.7 ^a
Valvular disorders	17.4	17.9	23.1	24.1	26.5	12.3	20	22.6	14.29
Varicose veins or CVI	17.4 ^b	25 ^b	15.4 ^b	44.8 ^b	61.8 ^b	54.4 ^b	28	45.2	47.1 ^a

QI = Quetelet index; CVI = Chronic Venous Insufficiency; TIA = Transient Ischaemic Attack; CVA = Cerebral Vascular Accident; COPD = Chronic Obstructive Pulmonary Disease. Hypertension (systolic or diastolic); visual impairment (cataract or blindness or glaucoma); overweight (25<QI<30); diabetes (insulin or non-insulin dependent); malignancies (any category). All values are percentages.

^a Significant age trend ($p<0.05$).

^b Significant difference between men and women in similar age group.

The age and sex specific prevalence of co-morbidities are depicted in Table 3. To improve readability, results of 6 co-morbidities all of which the age or sex specific highest prevalence did not exceed 10% were left out of Table 3. In the age group 65–74 years, there was a tendency for myocardial infarction to be more prevalent in men (41.3% vs. 20.7%) ($p=0.065$). In contrast, in the age group 75 to 84 years significantly more women suffered from hypertension (52.9% vs. 33.9%; $p=0.034$), arthritis (39.7% vs. 14.3%; $p=0.002$); obesity (20.6% vs. 5.4%; $p=0.014$) and thyroid disorders (16.2% vs. 1.8%; $p=0.007$) than men. No significant differences between men and women were observed in the age groups of 85 years and over.

In addition, Table 3 shows a changing pattern in the prevalence of co-morbidities with advancing age. With ageing, non-cardiovascular disorders became increasingly more important in terms of prevalence. There was a significant increase with age in the prevalence of dementia ($p<0.0001$); urine incontinence ($p<0.0001$), hearing impairment ($p<0.0001$), visual impairment ($p=0.0001$), varicose veins or chronic venous insufficiency ($p=0.018$) and osteoarthritis ($p=0.0002$). In addition, the prevalence of COPD ($p=0.045$), lipid metabolism disorders ($p=0.019$), obesity (0.016) and myocardial infarction ($p=0.007$) decreased significantly. In women, the prevalence of hypertension decreased significantly ($p=0.009$) with advancing age, while in men there was

virtually no change. Finally, in men the prevalence of disorders of lipid metabolism decreased significantly ($p=0.023$) compared to women.

4. Discussion

The elderly patients with heart failure in this study suffered from an array of concomitant disorders in addition to heart failure, with four or more co-morbidities present in over 80% of patients. The prevalence of these co-morbidities differed depending on age and sex. As expected, the prevalence of age-related non-cardiovascular conditions like hearing and visual impairments, urine incontinence, osteoarthritis and dementia rose significantly with increasing age. However, to our surprise the prevalence of myocardial infarction and hypertension (in women) decreased significantly with advancing age.

4.1. Interpretation of results

Our findings on the number of co-morbidities present in patients with heart failure are in agreement with previous reports [5,11,12]. The number and type of co-morbidities present have important implications. It is known that the presence of multi-morbidity has a negative effect on activities in daily life (ADL), quality of life (QoL) and prognosis [7,23,24].

While cardiovascular conditions like hypertension, myocardial infarction and angina pectoris are the most prevalent co-morbidities in patients aged 65–74 years, age-related health conditions not related to heart failure like dementia, hearing and visual impairments, osteoarthritis and urine incontinence predominate in the very elderly patient. Our results clearly demonstrate the need for an expansion of the focus on co-morbidity in patients with heart failure from merely the cardiovascular diseases towards prevalent non-cardiovascular health conditions, as described in this study.

We reported the incidence and prevalence of the best available general practice diagnosis of heart failure, which differs from previous reports and suggests that one in four very elderly patients has heart failure [1–3]. We realize that heart failure diagnosis in general practice often does not meet cardiologic standards. Most importantly, the use of echocardiography by general practitioners is limited by doctor, patient and organizational factors [25,26].

Although it appears to be a poor excuse to exclude patients with high age and frailty from having a correct diagnosis, the fact of the matter is that the combination of benign paternalistic views from doctors and patients wishing to avoid (hospital-based) additional investigations, prevents strict adherence to the scientifically just, but not patient orientated guidelines. Our validation technique with the unique registration methodology to eliminate incorrect registration of diagnoses (see Method section) and the use of combined cardiologist confirmed diagnosis and Walma score may not entirely meet ESC criteria, but seems to be a reasonable basis for interpretation of the current data in the context of general practice. The Walma score has similar diagnostic strength as both the Framingham and Boston scores [27]. With the current study design it was not possible to – in retrospect – assess cardiac function by echocardiography.

From a pathophysiological perspective, the decrease in the prevalence of hypertension in women is unexpected. These findings are not in agreement with the results of previous studies showing that hypertension is the major contributor in the development of heart failure due to diastolic dysfunction — a condition most prevalent in elderly patients and women [28,29]. However, results from a national survey in Scotland demonstrated that the number of consultations for hypertension drop steeply in patients aged 85 years and over [2]. It is possible that since doctors know the effect of preventive strategies in these older patients is limited, they will tend to under register and diagnose hypertension. Another explanation may be that patients with hypertension are at elevated risk for myocardial infarction and CVA and may not have survived to the age of 85+ years.

The presence of non-cardiovascular co-morbidity may hamper performance of meaningful interventions like self management and the use of effective medication in the management of heart failure. For instance, heart failure in patients with osteoarthritis may be exacerbated more frequently than in others, due to the use of over-the-counter NSAID's. A recent study in the Netherlands on the use of over-the-

counter NSAID's showed a 14% usage of NSAID's in patients with contraindications for NSAID use [30]. In addition, we suspect a major influence of the presence of (mild) cognitive impairment or dementia on both diagnosis and management of heart failure. Cognitively impaired patients are known to be less compliant with treatment [31]. They forget to take their medication and are difficult to train for non-medical interventions like daily weight control and exercise. Dementia, or its precursor mild cognitive impairment [31], was present in just under a quarter of our study population aged 85 years and over, this is probably an underestimation given the reported under diagnosis of dementia in general practice [32–34]. Several studies have suggested that heart failure is a contributing factor in the development of vascular cognitive impairment [35,36]. If so, a vicious circle can be imagined in which heart failure deterioration leads to cognitive impairment, which may cause increased non-adherence to heart failure treatment which subsequently leads to further deterioration.

4.2. Strengths and limitations

The strengths of our study are the studied population of elderly patients in general practice which represents the majority of heart failure patients; the focus on heart failure in the context of multi-morbidity and the unique, comprehensive description of the age and sex specific prevalence of an array of non-cardiovascular co-morbidities.

Some limitations are worth considering. First, over- and under diagnosis of heart failure in general practice is known and is in part a consequence of the presence of co-morbidity [37–39]. With the restriction of not having used echocardiography or an expert panel as the gold standard for diagnosis, we proved the diagnosis of heart failure in the CMR to be valid within the context of our study design and population. Our results should primarily be interpreted in the perspective of general practice, bearing in mind that the presented prevalence figures may be an overestimation of actual prevalence.

Secondly, only 70 patients in our study were aged 85 years or older. This limited number of very elderly patients may be acceptable for a descriptive study, but larger numbers will be required for future studies on the actual effect of non-cardiovascular co-morbidity on the diagnosis and management of heart failure. Finally, the number of co-morbidities studied was not infinite. Whether our list of studied co-morbidities was sufficient is open to debate. However, due to our step-wise selection approach we could not overlook any prevalent or relevant co-morbidity. To our knowledge the age and sex specific prevalence of co-morbidity in patients with heart failure in general practice has not previously been studied to this extent.

4.3. Future considerations

Ideally, a management guideline for heart failure – or any other chronic condition in elderly patients – should take

factors like co-morbidity and polypharmacy into account. A suggestion for guideline developers may be to clearly mark which treatment step results in the biggest health gain and/or QoL gain. In this way the doctor–patient decision to only partly follow a disease specific guideline can be directed towards the most optimal treatment choice.

Our results confirm that management of heart failure in elderly patients demands a patient orientated approach with awareness for and management of multi-morbidity [40,41]. Current heart failure disease management programs may be improved by inclusion of expertise from generalists. Geriatricians for instance could diagnose typical geriatric conditions and advise on heart failure management in the context of their findings [42]. However, current medical expertise in the majority of heart failure management programs is limited to cardiologist and/or specialized heart failure nurses [43].

Future studies should evaluate the actual effect of the presence of non-cardiovascular co-morbidities on heart failure diagnosis and management, and identify effective management strategies aimed at elderly patients with heart failure and co-morbidity.

Acknowledgements

We would like to thank all general practitioners of the CMR for their contribution to longitudinal morbidity recording.

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