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CLINICAL RESEARCH

Changes in characteristics of hospitalized heart failure patients in ten years: a single-center study

Evolution à dix ans des caractéristiques des patients hospitalisés pour insuffisance cardiaque : étude monocentrique

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KEYWORDS

Heart failure;
Epidemiology;
Etiologies;
Outcome.

Summary

Background. – Progress in therapy and the ageing patients hospitalized with heart failure may have impacted the characteristics of this patients.

Aims. – We compared epidemiological data of patients admitted with heart failure during two periods separated by a 10 year interval.

Methods. – Characteristics of 353 heart failure patients recruited between 2002 and 2004 with those of 304 heart failure patients recruited between 1992 and 1994 were compared retrospectively.

Results. – There is now a majority of male patients (56.4%) not found ten years ago. The average age is unchanged (75.1±11 then 76.4±11 years) even though the proportion of patients aged over 70 years has increased (75% versus 70%). Hospital length of stay has fallen from 14±9 to 10±7 days. Hospital mortality (8%) are identical. The two main etiologies remain coronary and hypertensive heart disease at 29 and 24% respectively but these proportions are lower than ten years ago (42 and 28% respectively). The ejection fraction is more often preserved (56%) than before (44%). Increased prescription of inhibitors of the renin-angiotensin system and beta-blockers is confirmed. Post-hospital and total mortality has fallen by 50 and 30% from 30 to 16% and 35 to 24% respectively at the expense of a 25% increase in the frequency of hospital readmissions from 29 to 38%.

Conclusion. – Even if mortality has declined, heart failure remains a major public health burden with a significant number of hospital readmissions. Other approaches such as therapeutic education must therefore be developed.

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MOTS CLÉS

Insuffisance
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Résumé

Justification. – Les progrès thérapeutiques et le vieillissement des patients hospitalisés pour insuffisance cardiaque doivent avoir un impact sur les caractéristiques de ces patients.

Objectifs. – Nous avons comparé les données épidémiologiques de patients hospitalisés pour insuffisance cardiaque durant deux périodes espacées de dix ans.

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Étiologies ; Évolution.

Méthodes. – Les caractéristiques de 353 patients insuffisants cardiaques recrutés entre 2002 et 2004 à celles de 304 patients insuffisants cardiaques recrutés entre 1992 et 1994 ont été comparées rétrospectivement.

Résultats. – Une majorité masculine (56.4%), qui n'existait pas dix ans plutôt, est apparue. L'âge moyen n'a pas évolué (75.1±11 puis 76.4±11 ans) même si la proportion de patients de plus de 70 ans a augmenté (75% contre 70 %). La durée d'hospitalisation est passée de 14±9 à 10±7 jours. La mortalité hospitalière(8%) est identique. Les deux étiologies principales restent les coronaropathies et l'hypertension artérielle avec respectivement 29 et 24% mais dans des proportions moindres que dix ans auparavant (respectivement 42 et 28%). La fraction d'éjection est plus souvent préservée (56%) qu'avant (44%). L'augmentation de prescription d'inhibiteurs du système rénine-angiotensine et de bêtabloquants est confirmée. Les mortalités post-hospitalière et totale ont baissé de 50 et 30% passant respectivement de 30 à 16% et de 35 à 24% au prix d'une augmentation du nombre de ré-hospitalisations de 25%, passant de 29 à 38%.

Conclusion. – Même si la mortalité baisse, l'insuffisance cardiaque reste un enjeu de santé publique avec un nombre de ré-hospitalisations important qui doit faire explorer d'autres pistes comme l'éducation thérapeutique.

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Heart failure (HF) remains a frequent reason for admission and readmission to hospital and therefore represents a major public health burden [1,2]. The ageing of the population and changes in HF management have impacted the characteristics of patients suffering from this disorder. We report here a comparative study in the same General Hospital center (CHG) on two cohorts at ten year intervals.

Materials and methods

The objective of our retrospective study was to compare epidemiological data for patients admitted with HF as main diagnosis (PMSI code) in the same GHC cardiology department during two periods separated by a 10 year interval: between January 1, 1992 and December 31, 1994 (Period 1) with an mean of 30 months follow-up on the one hand and between January 1, 2002 and December 31, 2004 (Period 2) on the other, with the same mean duration of follow-up. Patients admitted to hospital for acute coronary syndrome, patients in whom coronary artery or heart valve surgery was indicated and those who received multisite stimulation (therapy not available during period 1) were excluded. The diagnosis of HF was made from an analysis of clinical and radiological findings and the response to diuretic treatment according to guidelines [3] Serum creatinine levels confirmed the diagnosis of severe renal insufficiency when this parameter was higher than 250 micrograms per liter, either on admission or during hospitalization. The proportion of patients who received transthoracic Doppler echocardiography (TTE) was very high: 92% and the same for both periods so that only these patients were selected. This investigation contributed to the etiological assessment complementing the existence of a history of myocardial infarction, hypertension and severe heart valve disease. The diagnosis of hypertrophic cardiomyopathy if left ventricular hypertrophy (interventricular septum \geq 13 mm) was observed outside high blood pressure and dilated cardiomyopathy when the left ventricle was dilated (end-diastolic diameter greater than 55 mm) after excluding other causes. In addition, this investigation made it possible to distinguish heart failure with preserved left ventricular systolic func-

tion (HF-PSF) when the ejection fraction (EF) was \geq 50% and heart failure with impaired systolic function (HF-ISF) when it was $<$ 50%. Finally, the systolic pulmonary artery pressure (SPAP) was evaluated (normal value lower than 45mmHg). Discharge medication was systematically noted. Patient follow-up was conducted by telephone to study mortality and hospital readmissions. Quantitative variables are described using means, standard deviations and minimal and maximum values. Qualitative variables are expressed as sample sizes and percentages. Student's t-test and Chi-square tests were used for comparative analysis.

Results

During period 1 (1992-1994), 330 patients, including 304 who underwent transthoracic echocardiography, were hospitalized for HF out of 1.725 admissions to the cardiology department, *i.e.* 19.1% of admitted patients (330/1725). For period 2 (2002-2004), this proportion was 19.4% *i.e.* 383/1976 (with 353 investigated by TTE): the difference was not statistically significant. Clinical, electrocardiography and echocardiography data are given in table 1. The sex distribution differed in the two periods: There was a significant male majority for the current period with 56.4% of men ($p<0.001$) whereas, ten years ago, no difference between the sexes was observed (53.6% men with $p = ns$). The current mean age of patients is 76.4±11.4 years (range: 19-99 years) and was 75.1 ± 11.2 years (range: 35-97 years) ten years earlier ($p = ns$) even if 70% (214/304) of the patients were over 70 years *versus* 75% (265/353) now ($p=ns$). Currently, patients hospitalized for HF are mainly (218/353) in NYHA class III (62%) whereas ten years earlier, they were mainly (196/304) in NYHA class IV (65%). The diagnosis of global HF was made in 56.6% (200/353) of cases for period 2 *versus* only 37% (113/304) ten years earlier ($p<0.001$). Rhythm disorders were observed in 49.6% (175/353) of patients for period 2 whereas they were recorded in 82% (249/304) of cases during period 1 ($p<0.001$). Atrial fibrillation (AF) remained the most frequent arrhythmia and was observed in 36.8% (130/353) of hospitalized patients: this rate was similar ten years before (107/304

Table 1 Changes in clinical and paraclinical characteristics.

	2002-2004	1992-1994	p
Number of patients	n = 353	n = 304	
Age (years)	76.4 ± 11.4	75.1 ± 11.2	ns
Male sex % (n)	56.4 (199)	53.6 (163)	ns
Female sex % (n)	43.6 (154)	46.4 (141)	ns
NYHA III % (n)	62 (218)	25 (77)	< 0.001
NYHA IV % (n)	23 (80)	64 (196)	< 0.001
Global heart failure % (n)	56.6 (200)	37 (113)	< 0.001
Rhythm disorders % (n)	49.6(175)	82(249)	< 0.001
- Atrial fibrillation % (n)	36.8 (130)	35.2 (107)	ns
- Others (SVT excluding FA, VES, AES)	12.5 (45)	46.6 (142)	< 0.001
Left BBB % (n)	13.6 (48)	17.1 (52)	ns
HF-PSF % (n)	55.8 (197)	44.4 (135)	< 0.01
HF-ISF % (n)	44.2 (156)	55.6 (169)	< 0.01
LVH % (n)	39.4 (139)	30.2 (92)	< 0.05
LV Dilatation % (n)	41.7 (160)	48 (146)	< 0.01
PAH % (n)	21.2 (75)	20.1 (61)	ns
Associated diseases % (n)	68.3 (241)	71 (216)	ns
- Diabetes % (n)	28 (100)	28.6 (87)	ns
- Respiratory insufficiency % (n)	18.1 (65)	18.1 (65)	ns
- Chronic kidney failure % (n)	8.8 (31)	11.6 (36)	ns
- Thyroid dysfunction % (n)	13 (46)	6.6 (20)	< 0.01
Triggering factors % (n)	68.8 (242)	80.6(245)	< 0.001
- Acute respiratory infections % (n)	19.3 (68)	25.4 (77)	ns
- Acute rhythm disorders % (n)	19.3 (68)	16.5 (50)	ns
- Hypertensive flare-up % (n)	11.9 (42)	14.8 (45)	ns
- Inadvertent treatment withdrawal % (n)	5.7 (20)	5.6 (17)	ns
- Acknowledged deviation from diet % (n)	5.7 (20)	4.3 (13)	ns
- Iatrogenic causes* % (n)	3.7 (13)	9.2 (28)	< 0.01

*Excessive water and salt infusion, administration of corticosteroids, negative inotropic treatment.

i.e. 35.2%). Other rhythm disorders, represented by other supraventricular tachycardias and atrial and ventricular extrasystoles were more frequently observed during the first period (46.6% *versus* 12.5% now). The presence of a complete left bundle branch block was stable (52/304 *i.e.* 17.1% for period 1 *versus* 48/353 or 13.6% for period 2). This was more often observed ($p < 0.05$) in patients with a fall in the ejection fraction (21% on average for the 2 periods) whereas it was only observed in a mean of 9% of those with a preserved ejection fraction. Sixty-eight percent of patients (241/353) had a concomitant chronic disease such as diabetes, chronic respiratory insufficiency, chronic renal failure or dysthyroidism. Diabetes was the most frequent concomitant disease though the proportion has not changed in ten years (28 and 28.6%). A main predisposing factor for acute HF was demonstrated in 68.8% of cases (243/353) whereas it was previously found in 80.6% (245/304) ($p < 0.001$): bronchopulmonary infections and arrhythmias were the most often involved. In ten years, the proportion of HF-PSF has been reversed: it was previously observed in 44.4% patients whereas currently, it predominates at 55.8% ($p < 0.001$). Left ventricular hypertrophy (LVH) was detected in 151 patients or 39.4% (139/353) of cases in the recent group *versus* 30.3% of patients 10 years ago (92/304) showing a significant increase ($p < 0.05$). The proportion of patients with pulmonary arterial hypertension (PAH) is identical in the 2 periods: 20.1% (61/304) during period 1

and 21.2% (75/353) during period 2. The etiologies of HF are listed in table 2. Currently, ischemic (28.9%) and hypertensive heart disease (24%) remain the two most frequent etiologies but in statistically smaller proportions than ten years earlier (42.4 and 27.6% respectively). On the other hand, there has been a significant increase in the proportion of dilated cardiomyopathies from 12.2 to 19.3%. It should be noted that the proportion of other types of heart disease (such as cor pulmonale, congenital and toxic heart disease) and heart disease of undetermined cause increased significantly from 5.2 to 18.4%. Among these; the proportion of HF-PSF was statistically greater (table 2). The hospital outcome is reported in table 3. For period 2, the mean length of stay (LOS) was 10 ± 7 days (range between 1 and 51 days) whereas over period 1, it was 14 ± 9 days (range from 1 to 44): the difference is significant ($p < 0.001$). Complications during the hospital phase remained frequent: they occurred in 135 of the 353 patients (38.2%) during period 2 and in 124 of the 304 patients (41.7%) during period 1 ($p = ns$). For period 2, death occurred in 8.5% of cases (30/353), renal insufficiency in 10.7% of cases (38/353) and a rhythm or conduction disorder in 4.8% of cases (17/353). Ten years earlier, death (7.6% or 23/304) and renal insufficiency were as frequent (10.5%: 32/304) ($p < 0.001$) but rhythm or conduction disorders occurred significantly more often (13.1% or 40/304). Discharge medication is specified in table 4. Although there was a fall in the prescription of digitalis pre-

parations, calcium channel blockers and nitrates, the prescription of inhibitors of the renin-angiotensin system and especially that of beta-blockers significantly increased. Post-hospital follow-up concerned 266 patients (15 lost to follow-up and 23 hospital deaths were excluded) over period 1 with a mean follow-up duration of 30 ± 17 months (range: 24-48) and 284 patients (39 lost to follow-up and 30 hospital deaths) over period 2 with a mean duration of 30 ± 16 months (range:12-36) (table 5): Post-hospital mortality clearly fell in

ten years passing from 30 to 16.5% ($p < 0.001$) and total mortality (hospital and post-hospital), also significantly decreased by 31%, from 35.6% (103/289) to 24.5% (77/314). This gain only significantly concerned patients with HF-ISF (table 6). For the period 2 cohort, 38% of patients (108/284) were readmitted to hospital for HF at least once, compared to a value of 28.6% of patients (76/266) over period 1 (significant increase of 25%). This increase mainly involved ($p < 0.05$) patients with HF-ISF (table 5).

Table 2 Changes in etiologies of heart failure.

	2002-2004	1992-1994	p
Number of patients	n = 353	n = 304	
History of MI* % (n)	28.9 (102)	42.4 (129)	< 0.001
History of HT** % (n)	24 (85)	27.6 (84)	< 0.05
Dilated cardiomyopathy % (n)	19.3 (68)	12.2 (37)	< 0.05
Severe valve diseases % (n)	6.2 (22)	9.2 (28)	ns
Hypertrophic Cardiomyo. % (n)	3.2 (11)	3.4 (10)	ns
Other heart diseases and*** % (n)	18.2 (65)	5.2 (15)	< 0.001
heart disease of undetermined cause			
With HF-PSF % (n)	15.3 (54)	2.6(8)	< 0.001
With HF-ISF % (n)	3.1 (11)	2.3(7)	ns

*Myocardial infarction. **Hypertension.

***Cor pulmonale, congenital cardiopathy, toxic cardiopathy and heart disease of undetermined cause.

Table 3 Hospital outcome.

	2002-2004	1992-1994	p
Number of patients	n = 353	n = 304	
Length of hospital stay (days)	10 ± 7	14 ± 9	< 0.001
Total complications % (n)	38.2 (135)	41.7 (127)	ns
Hospital mortality % (n)	8.5 (30)	7.6 (23)	ns
Renal failure % (n)	10.7 (38)	10.5 (32)	ns
Ryth. and cond. disorders % (n)	4.8 (17)	13.1 (40)	< 0.001
Others* % (n)	13.3 (47)	9.5 (32)	ns

*Cardiovascular collapse, hepatic insufficiency, hyponatraemia, arterial or venous thromboembolic accidents.

Table 4 Changes in discharge medication.

	2002-2004	1992-1994	p
Number of patients	n = 323	n = 281	
Diuretics % (n)	92.6 (299)	94.3 (265)	ns
ACEi or AIIRA % (n)	73.4 (237)	65.8 (185)	< 0.05
Amiodarone % (n)	43 (139)	6.3 (102)	ns
Platelet aggregation inhibitors % (n)	42.7 (138)	39.1 (110)	ns
Vitamin K antagonists % (n)	37.9 (122)	13.9 (39)	< 0.001
Calcium antagonists % (n)	8 (26)	19.2 (54)	< 0.001
Digoxin % (n)	15.8 (51)	36.3 (102)	< 0.001
Betablockers % (n)	13.6 (44)	7.1 (20)	< 0.01
Nitrates % (n)	11.5 (37)	55.5 (156)	< 0.001

Table 5 Post-discharge outcome (Excluding patients lost to follow-up and hospital deaths).

	2002-2004	1992-1994	p
Number of patients	n = 284	n = 266	
Mean follow-up (months)	30 ± 16	30 ± 17	ns
Post-hospital deaths % (n)	16.5 (47)	30 (80)	< 0.001
Hospital readmissions % (n)	38 (108)	28.6 (76)	< 0.05
With HF-PSF % (n)	34.6 (55)	26.3 (31)	ns
With HF-ISF % (n)	42.7 (53)	30.4 (45)	< 0.05

Table 6 Changes in total mortality (Hospital and posthospital) according to ejection fraction.

	2002-2004	1992-1994	p
All patients % (n/N)	24.5 (77/314)	35.6 (103/289)	< 0.01
With HF-PSF % (n/N)	22 (39/176)	28.5 (37/130)	ns
With HF-ISF % (n/N)	27.5 (38/138)	41.5 (66/159)	< 0.05

Discussion

There are few data in the literature about HF in the French population. Beside registries and surveys, we thought it interesting to analyze the epidemiologic data for this disorder at an interval of ten years in the same hospital center. Even if the number of hospitalizations in this department has increased by 14.5%, from 1.725 to 1.976, there was no statistical difference in the proportion of patients admitted for HF between the two periods (17.6% *versus* 19.4%). In 2005, data obtained in the “sentinel” network [4] on the prevalence and management of HF in subjects aged 60 years or more seen by GPs were published: The prevalence increased with age and exceeded 20% from 80 years. Likewise, most hospitalized patients were aged over 75 years [5]. In our series, the proportion of patients aged over 70 years increased from 70 to 75% although there was no significant increase in the average age. Cohen-Solal [6] in 1997, on a multicentre series concerning 1.058 patients admitted to hospital for HF over 1 month and, Dujardin [7], in 1999-2000, on 1.772 patients in several cardiology departments over two close periods reported similar epidemiological data to ours for the most recent period. Moreover, our study revealed that these data have not changed for ten years. On the other hand, the proportion of HF-PSF in the series of Dujardin, using the same EF cut-off of 50%, is lower (30%) than in our series (55.8%). This difference may partly be explained by the significant increase in the number of cardiopathies of undetermined cause or other cause than the etiologies recognized in the “preserved ejection fraction” group (table 2). In addition, it is possible that the progressive generalization of the use of Brain Natriuretic Peptide (BNP) [8,9] allows a positive diagnosis of heart failure whereas the determination of underlying cardiopathy is unequivocal. We therefore note that the proportion of diagnosed HF-PSF has increased in ten years and now represents a majority of cases compared to HF-ISF with the same diagnostic criteria. The prevalence of HF-PSF is evaluated differently in the literature depending on the cut-off values: in the meta-analysis of Vasan [10], its

proportion ranged between 13% to 75% and more recently the figures converge at around 50% [11,12,13,14]. The increase, after discharge from hospital, in the prescription of inhibitors of the renin-angiotensin system and beta-blockers confirms their efficacy [15] since post-hospital mortality was reduced in our study. On the other hand, in ten years, we noted a 25% increase in the number of hospital readmissions: These hospital readmissions which statistically involved more patients with HF-ISF, are possibly due to the reduction in mortality which mechanically increases the number of remaining patients with heart failure or a trend for the ageing of this population. In our study, the mean length of hospital stay was shortened by almost 30% in 10 years from 14 to 10 days. The rate of complications of about 40% including hospital mortality (8%) was identical showing that this disorder remains serious [16]. Our study confirms that the total mortality fell, probably because of the wider prescription of beta-blockers and inhibitors of the renin-angiotensin system, and this fall was significant in HF-ISF patients so that, currently, the mortality is the same whatever the ejection fraction as in the most recent studies [14,17].

Conclusion

This single-center study conducted at an interval of ten years clarifies the changes in epidemiological data for hospitalized HF patients: although age remained statistically stable, a male prevalence appeared. HF-PSF patients are now in the majority. LOS was shorter by 30% but hospital mortality remained the same at around 8%, so that heart failure is still a serious disorder. Although the mortality at 30 months and total mortality fell (by 50 and 30% respectively) thanks partly to an increase in the prescription of inhibitors of the renin-angiotensin system and beta-blockers, the hospital readmission rate increased by 25% especially in patients with a lowered ejection fraction, which should lead to the development of other approaches such as therapeutic patient education

[18]. The proportion of patients with ischemic and hypertensive heart disease fell with an increase in other etiologies confirming the improved care for coronary heart disease and high blood pressure. The total mortality is currently identical in HF patients whatever the ejection fraction. Neurohormonal activation which has been used increasingly over the last ten years, has only improved only the vital prognosis in HF-PSF. A more specific therapy for HF-PSF must therefore be defined as the total mortality in this condition has remained stable during this same decade.

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