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Diplôme d'Etat

par

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TITRE

Impact de la réalisation d'une échographie cardiaque transthoracique
dans la prise en charge initiale des patients de plus de 75 ans
hospitalisés pour Insuffisance Cardiaque Aiguë.

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Titre :

Impact de la réalisation d'une échographie cardiaque transthoracique dans la prise en charge initiale des patients de plus de 75 ans hospitalisés pour Insuffisance Cardiaque Aiguë.

Résumé :

Introduction : La population gériatrique, en constante augmentation dans notre société, présente des besoins médicaux complexes en raison de la fréquence élevée des comorbidités et de la polymédication. L'insuffisance cardiaque constitue l'une des maladies cardiovasculaires la plus fréquente chez le sujet âgé. 75% des patients hospitalisés pour insuffisance cardiaque aiguë (ICA) ont plus de 75 ans. Le pronostic de cette pathologie demeure défavorable avec une moyenne de survie d'environ 4 ans. Les recommandations des sociétés savantes sont robustes notamment en ce qui concerne la réalisation d'une échographie transthoracique (ETT) à la phase aiguë d'une décompensation cardiaque. Toutefois, plusieurs études suggèrent que les patients âgés bénéficient moins fréquemment d'une prise en charge optimale. L'objectif principal de notre étude était d'évaluer les facteurs influençant la réalisation de l'échographie cardiaque ainsi que son impact sur la durée de séjour. L'objectif secondaire était d'analyser l'influence de l'ETT sur divers paramètres de prise en charge et d'évolution clinique.

Méthode : Nous avons conduit une étude observationnelle rétrospective portant sur les patients hospitalisés pour insuffisance cardiaque aiguë en Médecine aiguë gériatrique de janvier 2023 à août 2024. Les critères d'inclusion comprenaient la présence de symptômes et signes cliniques ainsi que des données paracliniques permettant de conclure à une ICA. Les patients hospitalisés pour un motif autre que décompensation cardiaque ont été exclus ainsi que ceux pour lesquels l'ETT n'était pas indiquée (patients trop altérés ou ETT récente). Pour chaque patient, les données échographiques, les traitements administrés ainsi que la durée de séjour ont été recueillis et comparés selon la réalisation de l'ETT. Les critères secondaires incluaient les complications gériatriques, les réhospitalisations et les récurrences.

Résultats : 132 patients ont été inclus, 74 ont bénéficié d'une échocardiographie tandis que 58 n'en ont pas bénéficié. La médiane de la durée de séjour était de 11,50 jours [8.00, 18.00], 12.50 jours [8.00, 22.00] dans la cohorte avec ETT et 9 jours [7.00, 15.00] pour ceux n'ayant pas bénéficié d'ETT ($p = 0.046$). L'analyse multivariée confirme la durée de séjour plus longue dans le groupe avec ETT avec $p = 0.043$. Elle est également significativement plus longue dans le groupe avec un syndrome de désadaptation psychomotrice, $p = 0.011$.

Conclusion : La durée de séjour tend à être plus longue avec la réalisation de l'ETT. Cet allongement peut s'expliquer par le délai pour obtenir l'échographie. Plusieurs facteurs peuvent influencer la durée de séjour, surtout dans une population gériatrique. Son étude n'est peut-être pas un bon reflet de la qualité de prise en soins et donc de la qualité de vie dans notre population gériatrique.

Mots clés : Echographie cardiaque transthoracique, insuffisance cardiaque, gériatrie

Title:

Impact of Transthoracic Echocardiography on the Medical Management of Patients Aged 75 and Over Hospitalized for Acute Heart Failure

Abstract:

Introduction: The ageing population is associated with increasingly complex medical care, characterized by a high burden of comorbidities and widespread polypharmacy. Heart failure (HF) is among the most prevalent and representative cardiovascular conditions in older adults, with approximately 75% of patients hospitalized for acute HF being aged 75 years or older. The prognosis remains poor, with a mean survival of approximately four years. Early use of transthoracic echocardiography (TTE) is recommended in the initial management of acute HF. However, multiple studies have highlighted suboptimal management in older populations. The primary objective of our study was to identify the factors associated with the performance of TTE and to evaluate its impact on hospital length of stay (LOS). The secondary objective was to examine the association between TTE and clinical complications and outcomes.

Methods: This retrospective observational study was conducted in the Acute Geriatric Department (AGD) between January 2023 and August 2024. All patients admitted with initial symptoms and a confirmed diagnosis of acute heart failure (HF) were included. Patients hospitalized for other primary diagnoses were excluded. Patients for whom the indication was not clearly established were also excluded (recent TTE or altered state). Data regarding transthoracic echocardiography (TTE), medical management, and clinical complications were extracted from electronic medical records within the hospital database.

Results: A total of 132 patients were included in the analysis, of whom 74 underwent TTE. The overall median length of stay (LOS) was 11.5 days [IQR: 8.00–18.00]; specifically, 12.5 days [8.00–22.00] in the TTE group and 9 days [7.00–15.00] in the non-TTE group ($p = 0.046$). Multivariate analysis revealed that LOS was independently longer with the performance of a TTE ($p = 0.043$). It was also significantly longer in the group with psychomotor disadaptation syndrome ($p = 0.011$).

Conclusion: TTE was associated with a longer hospital stay in this geriatric cohort. This may be partly attributed to delays in obtaining the echocardiographic examination, although multiple confounding factors may also contribute. Importantly, LOS should not be considered a reliable indicator of the quality of medical care or of patient quality of life, particularly in older populations, where functional decline and complex clinical trajectories are frequent.

Key words:

Transthoracic echocardiography, heart failure, geriatric

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SERMENT D'HIPPOCRATE

En présence des enseignants et enseignantes de

cette Faculté, de mes chers condisciples et

selon la tradition d'Hippocrate,

je promets et je jure d'être fidèle aux lois de l'honneur et de la probité dans
l'exercice de la Médecine.

Je donnerai mes soins gratuits aux indigents, et n'exigerai jamais un salaire au-
dessus de mon travail.

Admise dans l'intérieur des maisons, mes yeux ne verront pas ce qui s'y
passe, ma langue taira

les secrets qui me seront confiés et mon état ne servira pas à corrompre les mœurs ni
à favoriser le crime.

Respectueuse et reconnaissante envers mes Maîtres, je rendrai à leurs enfants

L'instruction que j'ai reçue de leurs parents.

Que les hommes et les femmes m'accordent leur estime si je suis fidèle à mes
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I. Acronyms

HF: Heart Failure

ESC: European Society of Cardiology

TTE: Transthoracic Echocardiography

LVEF: Left Ventricular Ejection Fraction

GMD: Geriatric Medical Department

LOS: Length of stay

AGD: Acute Geriatric Department

MISP: Medicalized Information System Program

ICD-10: International Statistical Classification of Diseases

NT-proBNP: N-terminal pro-Brain

Natriuretic Peptide ADL: Activities of

Daily Living iADL: Instrumental Activities

of Daily Living

HAH: Hight Authority of Health

LOS : length of stay

II. Introduction

The global ageing population is increasing steadily, and elderly individuals will constitute a growing proportion of the world's demographic profile in the coming decades. According to the World Health Organisation, the proportion of people aged 60 years and older is projected to nearly double, from 12% in 2015 to 22% in 2050, with an estimated 426 million people aged ≥ 80 years by that time (1). In France, demographic projections indicate that one in three individuals will be aged 60 years or older (1). The healthcare management of older adults is therefore a critical public health challenge. This population often presents multiple comorbidities and frailty; in 2011, individuals aged ≥ 75 years in France had an average of 2.63 chronic diseases (3). Among them, cardiovascular diseases are the prevalent (2).

Heart failure (HF) is the most frequent cardiac disease. In the world, HF affects approximately 64,3 million people (3). In France, in 2022, it affected 2.6% of the adult population, with a mean age of 83.3 years for women and 77.7 years for men (4). One-year mortality reaches 34% (4). Despite major advances in acute and chronic HF, supported by updated recommendations from the European Society of Cardiology (ESC) (5), disparities persist between the management of older and younger patients. For example, the EuroHeart Failure Survey II reported underuse of guideline-directed medical therapy in patients aged ≥ 80 years. Similarly, transthoracic echocardiography (TTE) is performed significantly less frequently in older adults (6). This could come from the difficulty to diagnose heart failure in elderly patients, especially the preserved ejection fraction one. It relies primarily on clinical signs of congestion, such as dyspnoea, legs oedema, and pulmonary crackles; however, these signs lack sensitivity in older adults with multiple comorbidities (7). Other atypical presentations may include low body mass index, anorexia (8), or geriatric syndromes such as delirium or falls (9).

In this multimodal management, two diagnostic tests allow and facilitate the definitive diagnosis of acute HF: the B-type natriuretic peptide measurements, even though some situations might influence it (acute renal disease for example (10)), and the transthoracic echocardiography. The TTE helps to evaluate the heart in its globality, from the anatomy and its structure to ventricular function and filling pressures. According to ESC guidelines, the TTE should be performed in the early 48 hours for new-onset HF or unknown left ventricular ejection fraction (LVEF) and cardiac structure (11). Despite being a class I recommendation, this exam remains underperformed in elderly patients (6).

Most studies define “older adults” as individuals aged ≥ 65 years; however, data specifically addressing to the very elderly population are limited. Furthermore, little is known about the impact of delays in performing TTE in acute HF in elderly population. At the Tours University Hospital, one of the two main hospitals in the Centre-Val de Loire region of France, the Geriatric Medical Department (GMD) doesn't have an ultrasound machine. Our observations suggest that most elderly

inpatients do not undergo TTE during hospitalization for acute HF, leading to delays in diagnosis and therapeutic optimization due to the absence of objective confirmation of cardiac dysfunction. Delays in accessing diagnostic examinations contribute to prolonged length of stay (LOS), which can be particularly detrimental to older patients, as hospitalization is associated with an increased risk of functional decline—some of which may be preventable (12).

This study may help optimize early diagnostic for acute heart failure in older adults, thereby reducing delays in targeted management. Such improvements could ultimately prevent hospital-acquired dependency and preserve functional independence in this vulnerable population.

The aim of this retrospective study was to evaluate the impact of performing transthoracic echocardiography in elderly patients admitted with acute heart failure. The primary outcome measure was length of hospital stay. Secondary outcomes included the effect of transthoracic echocardiography on mortality, hospital readmission, and geriatric complications such as falls, delirium, psychomotor desadaptation syndrome, and loss of functional independence.

III. Material and Methods

a. Design

This was a retrospective, observational, descriptive and monocentric study, focused on the Acute Geriatric Department (AGD) of the University Hospital Center of Tours. We included all the patients hospitalized for acute heart failure from January 2023 to August 2024. Data were collected by a physician from the medical field of each patient from the hospital's database.

The medical records were identified by the hospital's medical information department using the hospital medico-administrative database (MISP). MISP is the national coding system for the hospital stays based on the International Statistical Classification of Diseases (ICD-10).

This pre-screening was carried out using the codes 'I50', 'I11' and 'I13' for the main diagnosis. Then, the principal investigator returned to the file to collect the variables of interest.

b. Inclusion criteria

We included all the patients of 75 years old or more hospitalized for heart failure in the Acute Geriatric Medical Department (AGD) of the Regional University Hospital Center of Tours. Patients are eligible for inclusion whether they are admitted from the emergency department or directly from home. Heart failure was defined by at least one symptom (dyspnoea, orthopnoea), at least one clinical sign (right (jugular turgidity, hepatojugular reflux, legs oedema, ascites) and left (lungs congestion, radiological alveolar-interstitial syndrome) heart failure) and by high levels of NT-proBNPs ($\geq$ 300 pg/mL) (11).

c. Exclusion criteria

Patients were excluded if they were hospitalized for another pathology even if they developed acute heart failure during their hospitalization. For example, a patient was diagnosed with acute heart failure after a blood transfusion during his admission in the AGD. Patients for whom the indication for performing the echocardiography was not formal were also excluded. This concerned patients with critical illness or in a terminal phase and patients with a recent echocardiography.

d. Clinical and para clinical assessment

Data were collected by one physician and based on the hospitalisation report and, the emergency report. Demographic data were collected with a geriatric focus on the independence. We used universal scales: activities of daily living (ADL: 1 to 6) and instrumental activities of daily living (iADL: 1 to 8). For the lifestyle, we split into patients living at home and others living place including nursing homes and autonomy residency. We looked if there was any kind of home support, professional or familial.

We focused on the main comorbidities: chronic heart failure with the ejection fraction if known, myocardial ischemia, valvular disease, hypertension, diabetes, chronic kidney disease, stroke disease, neurocognitive disorders. The other comorbidities were included in the Charlson score.

The usual treatment, the symptoms and clinical signs, the trigger of the heart failure were collected from the hospitalisation report. We took the biological data (NT-proBNP, troponin and creatinine) from the first blood test made in the hospital, in the emergency or acute geriatric department. It was the same for X-ray results.

The following data were also collected based on the informatic field: treatment of the heart failure (intravenous or oral and the dose), complications (hypokalaemia, cardio renal syndrome, fall, confusion, autonomy loss, psychomotor disadaptation syndrome), outcomes (death or healing), discharge (home, rehabilitation service or nursing homes), rehospitalisation, relapse, cardiological appointment, medication.

e. Outcomes

The principal outcome was the impact of performing trans-thoracic echocardiography (TTE) on length of stay (LOS) in elderly patients admitted for acute heart failure. Data collected included the specialty of the physician performing the TTE, the delay, the measurements obtained, and the reason for not performing the TTE to identify potential confounding factors. The secondary outcomes were the rehospitalizations, the relapse and geriatrics complications.

f. Data Analysis

Statistical analyses were performed using Medistica, pvalue.io, a graphic user interface to the R statistical analysis software for scientific medical publications and JASP (Version 0.95.0) [Computer software]. Data were described by groups using the appropriate statistical parameters (Pearson's Chi-squared test for qualitative variables with a sample size greater than 30, Fischer's exact test and Student test for quantitative variables depending of the sample size).

The bivariate and multivariate analyses were performed using a linear regression model. Statistical significance was defined by an acceptable alpha-risk of 5%.

g. Ethics

Our study complies with the Declaration of Helsinki. The French Data Protection Agency (N°2024_110) and ethics committee in human research approved the study protocol (n°2024 60). An informed consent has been obtained from the subjects (or their guardians).

IV. Results

a. Descriptive analysis

From the MISP, 189 medical records were selected. 33 patients were excluded because they were hospitalized for another reasons, even though acute heart failure occurred during their hospitalisation. Then, 24 patients with critical illness or in a terminal phase and patients with a recent echocardiography were excluded. From 132 patients included, the TTE was practices for 74 of them and 58 patients didn't have it.

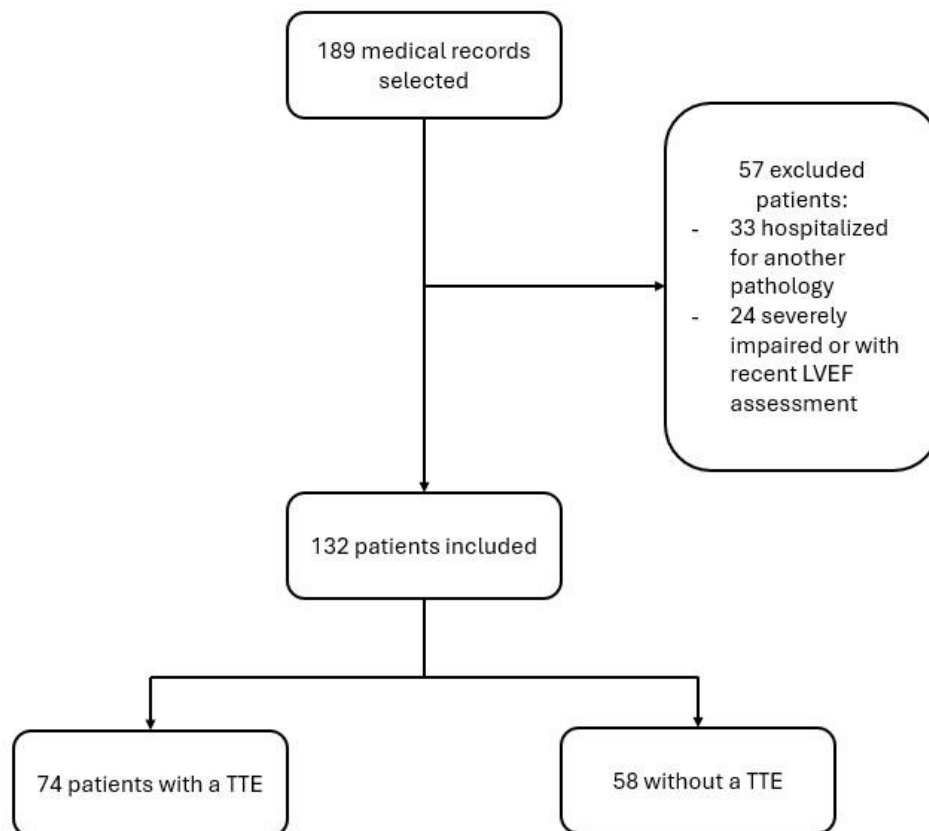


Figure 1. Flow chart

Characteristics	Total (n= 132)	TTE (n= 74)	No TTE (n= 58)
Feminine Sexe (%)	79 (60.0)	47 (64.0)	32 (55.0)
Age (median [IQR])	90.00 [86.8, 94.0]	90.00 [86.2, 93.7.]	91.00 [87.0, 94.0]
Lifestyle			
At home (%)	109 (83.0)	62 (84.0)	47 (81.0)
Others (%)	23 (17.0)	12 (16.0)	11 (19.0)
ADL* [Q1, Q3]	4 [3.00, 5.00]	4 [3.00, 5.00]	4 [3.00, 5.00]
iADL* [Q1, Q3]	2 [1.00, 5.00]	2 [1.00, 5.00]	2 [1.00, 4.00]
Help (%)	94 (71.0)	51 (69.0)	43 (74.0)
Antecedents/Medical history			
Heart Failure (%)	77 (58.0)	41 (55.0)	36 (62.0)
LVEF < 40% (%)	10 (7.5)	5 (6.7)	5 (8.6)
LVEF 40-60 % (%)	28 (21.2)	15 (20.2)	13 (22.4)
LVEF > 60 % (%)	29 (21.9)	17 (22.9)	12 (20.7)
Unknown (%)	65 (49.2)	37 (50.0)	28 (48.2)
Coronary Artery Disease (%)	45 (34.0)	28 (38.0)	17 (29.0)
Valvular Heart Disease	41 (31.06)	24 (32.4)	17 (29.3)
Aortic Valve Stenosis (% of valvular disease)	25 (61.0)	16 (66.6)	9 (52.9)
Mitral Insufficiency (% of valvular disease)	6 (14.6)	6 (25.0)	0 (0.0)
Aortic Insufficiency (% of valvular disease)	3 (7.3)	1 (4.2)	2 (11.8)
Tricuspid Insufficiency (% of valvular disease)	2 (4.9)	0 (0.0)	2 (11.8)
AVS * and MI * (%of valvular disease)	5 (12.2)	1 (4.2)	4 (23.5)
Rhythmic Heart Disease (%)	81 (61.0)	40 (54.0)	41 (71.0)
Hypertension (%)	86 (65.0)	48 (65.0)	38 (66.0)
Diabetes (%)	42 (31.8)	24 (32.4)	18 (31.0)
Chronic Kidney Disease (%)	48 (36.4)	26 (35.1)	22 (37.9)
Cerebral Stroke (%)	28 (21.2)	15 (20.3)	13 (22.4)
Cognitive-Disorder	33 (25.0)	17 (23.0)	16 (28.0)
Charlson Score [Q1, Q3]	7 [6, 9]	7 [6, 9]	7 [6, 9]
Usual Treatment			
Betablocker (%)	86 (65.1)	46 (62.1)	40 (69.9)
Angiotensin-converting enzyme inhibitor (%)	25 (18.2)	19 (25.6)	6 (10.3)
Angiotensin II antagonist (%)	25 (19.0)	19 (26.0)	6 (10.0)
Calcium antagonist (%)	26 (19.6)	17 (22.9)	9 (15.9)
ENTRESTO (%)	3 (2.3)	1 (1.4)	2 (3.4)
SGLT-2 inhibitor (%)	21 (16.0)	7 (9.5)	14 (24.0)
Anticoagulants (%)			
Oral anticoagulant (% of anticoagulated patients)	59 (81.0)	29 (78.0)	30 (83.0)
Vitamin K antagonist (% of anticoagulated patients)	14 (19.0)	8 (22.0)	6 (17.0)
Platelet Aggregation Inhibitor (%)	42 (32.0)	22 (30.0)	20 (34.0)
FUROSEMIDE (%)	97 (73.0)	50 (68.0)	47 (81.0)
Dose in mg [Q1, Q3]	55.0 [40.0, 120]	70 [20.0; 125.0]	40 [40.0; 80.0]
HYDROCHLOROTHIAZIDE (%)	9 (6.8)	4 (5.4)	5 (8.6)
SPIRONOLACTONE (%)	5 (3.8)	3 (4.1)	2 (3.4)
EPLERENONE (%)	4 (3)	3 (4.1)	1 (1.7)

Table 1. Characteristics of the population

*ADL: Activities of Daily Living; iADL: instrumental Activities of Daily Living; AVS: Aortic Valve Stenosis; MI: Mitral Insufficiency

The mean age was 90 years old which was similar between the TTE and no TTE groups. 83.0% of the patients were living at home and the average ADL and iADL was 4 and 2 respectively. At least half of the patients had hypertension either in the TTE group and the no TTE group. The other most represents comorbidities were rhythmic heart disease (54.0% in the TTE group and 71.0% in the other), heart failure (55.0% in the TTE group and 62.0% in the other), coronary artery disease (38.0% in the TTE group and 29.0% in the other one) and chronic kidney disease (35.1% in the TTE group and 37.9% in the other one). For 49.2% of patients with HF, no baseline left ventricular ejection fraction was documented in the medical record of the AGD and of the emergency department. The aortic valve stenosis was the most representative valvular disease with 61.0% patients in total. There were 25.0% patients with cognitive disorder.

Concerning their usual treatment, betablocker was prescribed for 65.1% patients in total, 62.1% for the TTE group and 69.9% for the no TTE group. ENTRESTO was present on only 3 prescriptions in total. FUROSEMIDE was found in 73% medical records, and the median posology was 55 mg, 70 mg in the TTE group and 40 mg in the no TTE group.

Dyspnoea and oxygen were significantly more present in the patients with TTE ($p=0.044$ and $p=0.019$). There was no other significant difference for the heart failure symptoms. Legs oedema, lung's congestion and radiological alveolar-interstitial syndrome were found for at least half of the patients in the TTE and no TTE cohorts.

The acute HF trigger's, cardiologic one was significantly more represented in the TTE group ($p=0.002$). We found a significant statistical difference between the 2 groups for the unknown trigger: it was more often found in the patients without TTE ($p=0.023$). Concerning the unknown trigger, no information was found in the medical record, or the clinicians didn't diagnose it. Infections concerned 33.8 % and 34.4 % in the TTE and no TTE cohort, respectively. The other main trigger was arrhythmia with 28.0 % of the TTE cohort and 8.6 % of the no TTE one. 5 patients had an iatrogenic trigger including a failure to follow a treatment of the continuous positive airway pressure, a dietary change, a diabetic imbalance or a pacemaker lead migration.

All patients included, the NT-proBNP median was 6528.00 ng/L [2943.25, 13778.50], the troponin one was 49.00 ng/L [30.30, 77.60] and the creatinine one was 132.00 $\mu\text{mol/L}$ [93.20, 182.50].

Characteristics of acute heart failure	Total (n= 132)	TTE (n= 74)	No TTE (n= 58)	p
Symptoms				
Dyspnoea (%)	102 (77.0)	62 (84.0)	40 (69.0)	0.044^a
Orthopnoea (%)	13 (9.8)	8 (11.0)	5 (8.6)	0.68 ^a
Oxygen (%)	72 (55.0)	47 (64.0)	25 (43.0)	0.019^a
Alveolar opacities (%)	69 (52.0)	39 (53.0)	30 (52.0)	0.91 ^a
Legs oedema (%)	98 (74.0)	55 (74.0)	43 (74.0)	0.98 ^a
Jugular turgidity (%)	44 (33.0)	24 (32.0)	20 (34.0)	0.8 ^a
Hepatojugular reflux (%)	29 (22.0)	13 (18.0)	16 (28.0)	0.17 ^a
Ascites (%)	2 (1.5)	1 (1.4)	1 (1.7)	1.000 ^b
Lung's congestion (%)	110 (83.3)	63 (85.1)	47 (81.0)	0.53 ^a
Trigger of HF				
Cardiologic	43 (32.6)	33 (44.6)	10 (17.2)	0.002^c
Myocardial infarction (%)	4 (3.0)	3 (4.1)	1 (1.7)	-
Arrhythmia (%)	26 (20.0)	21 (28.0)	5 (8.6)	-
Valvular (%)	12 (9.1)	8 (11.0)	4 (6.9)	-
Hypertension (%)	1 (0.8)	1 (1.4)	0 (0.0)	-
Pulmonary embolism (%)	0 (0.0)	0 (0.0)	0 (0.0)	-
Kidney failure (%)	9 (6.8)	7 (9.5)	2 (3.4)	0.3 ^b
Electrolyte imbalance (%)	11 (8.3)	8 (11.0)	3 (5.2)	0.35 ^b
Anaemia (%)	19 (14.0)	11 (15.0)	8 (14.0)	0.86 ^a
Iatrogenic (%)	5 (3.8)	1 (1.4)	4 (6.9)	0.17 ^b
Infectious (%)	45 (34.0)	25 (33.8)	20 (34.4)	0.93 ^a
Unknown (%)	41 (31.0)	17 (23.0)	24 (41.0)	0.023^a
Biology				
NT proBNP in ng/L [Q1, Q3]	6528.00 [2943.25, 13778.50]	6727.50 [2815.0, 15215.25]	6306.50 [3146.50, 12944.25]	0.56 ^c
Troponin in ng/L [Q1, Q3]	49.00 [30.30, 77.60]	49.00 [29.10, 81.10]	47.50 [31.60, 68.70]	0.25 ^c
Creatinine in µmol/L [Q1, Q3]	132.00 [93.20, 182.50]	127.50 [87.00, 184.75]	136.50 [102.00, 179.20]	0.55 ^c

Table 2. Clinical and biological characteristics of acute heart failure with the trigger

^a : Chi2 test (qualitative variables with a sample size greater than 30) ^b : Fisher's exact test (qualitative variables with a sample size less than 5) ^c : Student test (test for quantitative variables with a sample size greater than 30)

In the 74 patients who received a TTE, 35 was already admitted in the AGD. 42 echocardiography were made in the first 48 hours against 32 ones. The majority had a preserved left ventricular ejection fraction. There was not huge difference between the people with dilated non-compliant vena cava (27.0%) and non-dilated compliant vena cava (37.8%). But data were missing for B lines (91.9%) and filling pressures (54.1%).

	74
Physician's speciality	
Emergency physician (%)	4 (5.4)
Cardiologist (%)	35 (47.3)
Acute Geriatric Department (%)	35 (47.4)
Delay	
< 48 hours (%)	42 (56.8)
> 48 hours (%)	32 (43.2)
LVEF *	
Preserved (%)	45 (60.8)
Reduced (%)	23 (31.1)
Unknown (%)	6 (8.1)
Filling pressures	
High (%)	22 (29.7)
Non-elevated (%)	12 (16.2)
Unknown (%)	40 (54.1)
Vena cava	
Dilated and non-compliant (%)	20 (27.0)
Dilated and compliant (%)	10 (13.5)
Non-dilated and compliant (%)	28 (37.8)
Unknown (%)	16 (21.6)
B-lines	
Yes (%)	4 (5.4)
No (%)	2 (2.7)
Unknown (%)	68 (91.9)
Table 3. Performance and parameters of TTE	
<i>*LVEF: Left ventricular ejection fraction</i>	

About the 58 patients without TTE, it wasn't discussed in 62.1% of the medical records, meaning there was no evidence about it in the emergency report neither in the geriatric one. For 36.2% the delay was too long, and the patients were discharge before the date.

Concerning the treatment of HF, we noticed that oral furosemide was more used in the no TTE group (60.3 %). Intravenous diuretic was essentially used before the ultrasounds (59.45%), after them at least half of them had an oral prescription (54.0 %). The median posology of Furosemide was the same before and after TTE, and without ultrasounds (80mg [40, 125] before and 80mg [60, 240] after). Hydrochlorothiazide and Risordan were not much used in either group. There is not huge difference in the duration of treatment in both group (4 days [2,7] for the no TTE cohort and 5.5 days [2, 9] for the TTE one).

Medications	No TTE (58)	TTE (74)	
		Before	After
FUROSEMIDE			
Oral	35 (60.3)	28 (37.8)	40 (54.0)
Intravenous (%)	21 (36.2)	44 (59.5)	33 (44.6)
No information	2 (3.5)	2 (2.7)	1 (1.4)
Posology in mg [Q1, Q3]	100 [80, 160]	80 [40, 125]	80 [60, 240]
HYDROCHLOROTHIAZIDE (%)	7 (12.1)	2 (2.7)	5 (6.8)
RISORDAN (%)	0 (0.0)	4 (5.4)	2 (2.7)
Duration of treatment in days [Q1, Q3]	4 [2, 7]	5.5 [2, 9]	
Table 4. Treatment of the acute HF before and after TTE			

For the main outcome, the median length of stay overall was 11.5 days [8, 18]. Patients were hospitalized longer in the TTE cohort than in the no TTE one: 12.5 days [8, 22] against 9 days [7, 15] respectively, with p equals 0.046.

	Overall (132)	No TTE (58)	TTE (74)	p
LOS* [Q1, Q3]	11.5 [8, 18]	9 [7, 15]	12.5 [8, 22]	0.046^a
Deceased (%)	8 (6.06)	1 (1.7)	7 (9.5)	0.060 ^b
Healed (%)	123 (93.0)	56 (97.0)	67 (91.0)	0.300 ^c
Complications				
Cardiorenal syndrome (%)	15 (11.3)	5 (8.60)	10 (13.5)	0.379 ^b
Hypokalaemia (%)	33 (25.0)	15 (25.8)	18 (24.3)	0.840 ^b
Dependence (%)	26 (20.0)	9 (16.0)	17 (23.0)	0.290 ^b
Psychomotor Desadaptation Syndrome (%)	28 (21.0)	11 (19.0)	17 (23.0)	0.580 ^b
Confusion (%)	20 (15.0)	8 (14.0)	12 (16.0)	0.700 ^b
Falls (%)	12 (9.1)	8 (14.0)	4 (5.4)	0.096 ^b
Discharge				
Home (%)	80 (60.6)	41 (71.0)	39 (53.0)	0.036 ^b
Rehabilitation Unit (%)	29 (22.9)	10 (17.0)	19 (26.0)	0.25 ^b
Nursing home (%)	12 (9.6)	4 (6.9)	8 (11.0)	0.44 ^b
Other (%)	4 (3.0)	2 (3.4)	2 (2.7)	1 ^c
Relapse	55 (41.7)	28 (51.0)	27 (43.0)	0.38 ^b
Rehospitalisation	53 (40.1)	29 (54.0)	24 (38.0)	0.091 ^b
Cardiologic appointment (%)	49 (37)	26 (45)	23 (31)	0.1 ^b
Table 5. Complications and outcomes <i>*LOS: length of stay</i> <i>^a: Welch's test (A version of Student's t-test that does not assume equal variances between the two groups being compared. It is often used for samples of unequal sizes or when the assumption of homogeneity of variances is not met).</i> <i>^b Chi2 test (test for qualitative variables with a sample size greater than 30) ^c Fisher test (test for qualitative variables with a sample size less than 5)</i>				

Most of the patients healed from their acute heart failure (97.0% in the no TTE group and 91.0% in the TTE). But there are some patients not considered healed or dead: they had heart failure symptoms when they were transferred in another department, or they were discharge with palliative care at home. The most representative complication in each group was hypokalaemia (25.8% and 24.3% without and with TTE). Next come the geriatric syndromes at the same rank in the TTE and no TTE group: psychomotor desadaptation syndrome (23.0 % and 19.0%), loss of autonomy (23.0 % and 16.0%) and confusion (16.0% and 14.0%).

Regarding patient outcomes, the distribution was similar in both groups, with the majority discharged home: 52.7% in the TTE group and 54.0% in the non-TTE group. The remaining 3.2% of patients were transferred to a care facility. Heart failure relapse and rehospitalisation the year following were similar in both groups: 51% in the TTE group and 43% in the no TTE group, 38% in the TTE cohort and 54% in the no TTE one, respectively. 31% of the group without a TTE had an appointment with a cardiologist when discharge and 45% in the TTE one.

We collected the prescriptions at discharge. With the SGLT-2 inhibitor and spironolactone, Furosemide was the most added. It is also the most increased and maintained treatment with betablocker. Betablocker, angiotensin-converting enzyme inhibitors and angiotensin II antagonist were stopped in majority. Calcium antagonists were maintained the same in majority.

	Addition	Majoration	Idem	Stop
FUROSEMIDE (%)	17 (12.9)	61 (46.2)	39 (29.5)	8 (6.1)
HYDROCHLOROTHIAZIDE (%)	4 (3.0)	-	1 (0.7)	7 (5.3)
SPIRONOLACTONE (%)	10 (7.6)	-	5 (3.8)	-
BETABLOCKER (%)	8 (6.1)	7 (5.3)	51 (38.6)	15 (11.4)
Angiotensin-converting enzyme inhibitor (%)	8 (6.1)	1 (0.7)	10 (7.6)	15 (11.4)
Angiotensin II antagonist (%)	-	-	9 (6.8)	13 (9.8)
Calcium antagonist (%)	2 (1.5)	-	14 (10.6)	10 (7.6)
ENTRESTO	-	-	2 (1.5)	1 (0.7)
SGLT-2 inhibitor (%)	19 (14.4)	-	18 (13.6)	6 (4.5)
Table 6. Medications at discharge				

b. Univariate Analysis

The linear regression showed a statistically significant relationship between LOS and TTE, $p=0.046$. Concerning the geriatric syndromes, only falls and psychomotor desadaptation syndrome were statistically associated with LOS ($p=0.024$, $p<0.01$, respectively). There was no significant relationship for confusion and cognitive disorder.

c. Multivariate Analysis

By adjusting for falls, confusion, dependence, psychomotor desadaptation syndrome and cognitive disorder, there was a statistically significant relationship between LOS and TTE ($p=0.043$). Psychomotor desadaptation syndrome was also significantly linked to LOS ($p=0.011$). However, in the multivariate analysis, statistics were not significant for falls, adversely to the univariate one. No statistically significant relationship was found for confusion, dependence and cognitive disorder.

d. Subgroup Analysis

We made a subgroup analysis comparing patients without TTE and those who underwent TTE 48 hours after hospital admission, meaning there were all performed in the AGD. The same statistically significant relationship as in the univariate analysis was shown for TTE ($p= 0.034$). It also concerned the psychomotor desadaptation syndrome ($p< 0.01$). If we adjusted for falls, confusion, dependence, psychomotor desadaptation syndrome and cognitive disorder, LOS and TTE had a statistically significant relationship ($p< 0.01$). Concerning the geriatric syndromes, the statistics was also significant for the psychomotor desadaptation syndrome ($p<0.01$). Other variables had no significant statistics with $p> 0.05$.

V. Discussion

After excluding patients for whom the indication was not formal and according to current recommendations, absolutely all patients in our cohort should have undergone a TTE during their hospital stay. As in the EuroHeart Failure Survey II (6), there remain undeniable opportunities for improvement in the management of elderly patients. The results of the subgroup analysis on length of stay suggest that having an echocardiography device available in the acute geriatric unit could reduce the consequences of prolonged hospitalization. This includes hospital-acquired functional dependence, as indicated by findings related to psychomotor desadaptation syndrome. Locally, two geriatricians are trained in cardiac sonography. Despite the cardiology unit being in a different site in Tours, there are two cardiologists on-site to continue the collaborative management of elderly patients with cardiac disease.

Beyond the results themselves, this study enabled the creation of an authentic cardiogeriatric cohort. The only inclusion criterion was the presence of acute HF, allowing the inclusion of highly frail individuals, including those with cognitive impairment or functional dependency. Therefore, this cohort better reflects the actual geriatric population compared with many previous studies, which predominantly enrolled more robust patients with fewer comorbidities

However, the use of retrospective data extracted from medical records introduced a potential risk of assessment bias. Information regarding readmissions, heart failure relapses and cardiology consultations was exclusively sourced from the University Hospital of Tours' medical software. Missing data were systematically interpreted as the absence of corresponding clinical criterion, which may have led to underestimations. Furthermore, the occurrence of missing data highlights the variability in documentation practices across clinicians. For instance, key echocardiographic parameters such as filling pressures and B-lines were missing.

Perhaps, those limitations are inherent to retrospective studies and might have been reduced in a prospective design.

Then, numerous confounding factors affect the analysis of hospital length of stay (LOS). In geriatric populations, LOS is influenced by comorbidities, in-hospital complications, and functional decline. While multivariate analyses could adjust for these factors, they would also increase the risk of type I error due to multiple comparisons.

Selecting length of stay as the primary endpoint is subject to considerable debate. Indeed, a short length of stay reflects more of an economic consideration than a medical one. Hospitalization outcomes are typically assessed by either quantity of life, such as mortality, or quality of life, including reductions in morbidity and hospital-acquired functional dependence. However, as suggested by the 14,000 publications indexed on PubMed (search equation: length of stay [Title/Abstract], filtered for patients aged >80 years), this choice is not without justification. It appears relevant to postulate that shorter hospital stays are associated with reduced patient exposure to in-hospital complications (infectious, thrombotic, thymic...), and particularly to geriatric complications (13). The findings obtained on psychomotor desadaptation syndrome further support this perspective. This also represents a strength of our study. Despite this postulate, few papers in the literature examine the association between geriatric syndromes and length of stay.

Confusion and falls have been associated with prolonged length of stay; however, no causal relationship has been established. It remains unclear whether delirium and falls contribute to extended hospitalization or, conversely, whether longer stays increase the risk of developing delirium and falls (14). One study has reported a significant statistically correlation: the LOS in the emergencies leads to more delirium (15), a department not representative of general medical wards. In conclusion, while length of stay as an endpoint may be contentious, it is a well-established measure that offers substantial insights in our study.

Additionally, TTE is recommended in the management of acute heart failure (11). Beyond its diagnostic value, TTE provides essential prognostic information, especially concerning the left ventricle ejection fraction (LVEF) (16–18), and contributes to guide both acute and chronic HF therapy. However, TTE is less performed for the elderly, potentially due to the fact that they are less often admitted to cardiology departments compared to younger patients (6). A significant proportion of geriatric patients are hospitalised in general medical department, where clinicians may lack training in ultrasounds techniques and where ultrasound equipment is often unavailable. Lung congestion is one of the clinical signs of HF and can be evaluated through chest X-ray or thoracic ultrasounds. The presence of B-lines is a common finding in pulmonary congestion and pleural effusion. This examination is easily performed at the patient's bedside, whether in inpatient or outpatient settings. B-lines enhance the diagnostic of acute HF, with high sensitivity and specificity (19,20). Furthermore, lung ultrasound can be used to monitor treatment response as the number of B-lines tends to decrease with effective diuretic therapy (21–23). Recent advances include the development of ultrasound scanners incorporating artificial

intelligence (AI). This assists clinicians with no ultrasound experience in evaluating cardiac function, notably LVEF. A study conducted in the geriatric department of the Broca Hospital (Paris) demonstrated a strong correlation between ejection fraction measurements performed by a cardiologist and those performed by a geriatrician using such AI-assisted devices ($r = 0.941$, $p < 0.0001$) (24). These findings suggest that key ultrasounds parameters for diagnosing and monitoring acute HF may be made accessible to geriatricians with the aid of emerging technologies.

While clinical guidelines for chronic heart failure management are well established, adherence in geriatric settings remains suboptimal. In our cohort, not all patients with a LVEF $< 40\%$ was receiving the full recommended quadruple therapy at the admissions. At discharge, among the 23 patients with TTE-confirmed LVEF $< 50\%$, none were prescribed the complete treatment. This underutilization of evidence-based heart failure medications among older adults may reflect a gap in knowledge among clinician or concerns about adverse effects—such as hypotension, which increases fall risk and may precipitate complications like psychomotor disadaptation syndrome. Strengthening collaboration between geriatricians and cardiologists is imperative. As the population ages, the overlap between HF and geriatric syndromes becomes increasingly common (25), necessitating a multidisciplinary approach. This can be achieved through the development of cardio geriatrics as a subspeciality, with the training of geriatricians in cardiovascular disease and the integration of geriatric expertise within cardiology departments. For example, the ICREX-94 experience in Val-de-Marne (Paris) showed no difference in the 90-days prognosis between patients admitted to a traditional cardiology unit and those admitted to a cardio geriatric one. Patients hospitalized in the cardio geriatric department were older with lower level of independency and cognitive disorder (26). This highlights the relevance of personalized care models, especially to the geriatric profile.

VI. Conclusion

There is a significant statistical association between the LOS and TTE but in the contrary as our principal hypothesis. It seems that patients are hospitalised longer with TTE and when they fell and have a psychomotor desadaptation syndrome. The waiting for ultrasounds can be the origin of a longer LOS, but no causal link has been shown.

Regarding the relationship between length of stay and geriatric complications (falls and psychomotor desadaptation syndrome), despite significant findings, causality cannot be established. In other words, the direction of influence remains unclear. Taking care of geriatric patients' needs multidisciplinary management but also a knowledge of prevention to avoid all geriatric syndromes.

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Vu, le Directeur de Thèse

A handwritten signature in black ink, consisting of a large, sweeping loop on the left and a series of intersecting lines on the right.

**Vu, le Doyen
De la Faculté de Médecine de
Tours Tours, le**

Résumé

La population gériatrique, en constante augmentation dans notre société, présente des besoins médicaux complexes. L'insuffisance cardiaque constitue l'une des maladies cardiovasculaires la plus fréquente chez le sujet âgé dont la moyenne de survie est d'environ 4 ans. Les recommandations des sociétés savantes sont robustes notamment en ce qui concerne la réalisation d'une échographie transthoracique à la phase aiguë d'une décompensation cardiaque. Toutefois, plusieurs études suggèrent que les patients âgés bénéficient moins fréquemment d'une prise en charge optimale.

L'objectif principal de notre étude était d'évaluer les facteurs influençant la réalisation de l'échographie cardiaque ainsi que son impact sur la durée de séjour. L'objectif secondaire était d'analyser l'influence de l'ETT sur divers paramètres de prise en charge et d'évolution clinique. Nous avons conduit une étude observationnelle rétrospective portant sur les patients hospitalisés pour insuffisance cardiaque aiguë en Médecine aiguë gériatrique de janvier 2023 à août 2024. Tous les patients admis pour décompensation cardiaque furent inclus, tout autre motif d'hospitalisation étant exclus.

132 patients ont été inclus, 74 eurent une échocardiographie et 58 n'en ont pas eu. La médiane de la durée de séjour était de 11,50 jours [8.00, 18.00], 12.50 jours [8.00, 22.00] dans la cohorte avec ETT et 9 jours [7.00, 15.00] pour ceux n'ayant pas bénéficié d'ETT ($p = 0.046$). L'analyse multivariée confirme la durée de séjour plus longue dans le groupe avec ETT avec $p = 0.043$. Elle est également significativement plus longue dans le groupe avec un syndrome de désadaptation psychomotrice, $p = 0.011$. Plusieurs facteurs peuvent influencer la durée de séjour, surtout dans une population gériatrique, ne le rendant pas fiable pour évaluer la qualité de prise en soins et donc de la qualité de vie.

DARROU Perrine

33 pages – 6 tableaux – 1 figure

Résumé :

La population gériatrique, en constante augmentation dans notre société, présente des besoins médicaux complexes. L'insuffisance cardiaque constitue l'une des maladies cardiovasculaires la plus fréquente chez le sujet âgé dont la moyenne de survie est d'environ 4 ans. Les recommandations des sociétés savantes sont robustes notamment en ce qui concerne la réalisation d'une échographie transthoracique à la phase aiguë d'une décompensation cardiaque. Toutefois, plusieurs études suggèrent que les patients âgés bénéficient moins fréquemment d'une prise en charge optimale. L'objectif principal de notre étude était d'évaluer les facteurs influençant la réalisation de l'échographie cardiaque ainsi que son impact sur la durée de séjour. L'objectif secondaire était d'analyser l'influence de l'ETT sur divers paramètres de prise en charge et d'évolution clinique. Nous avons conduit une étude observationnelle rétrospective portant sur les patients hospitalisés pour insuffisance cardiaque aiguë en Médecine aiguë gériatrique de janvier 2023 à août 2024. Tous les patients admis pour décompensation cardiaque furent inclus, tout autre motif d'hospitalisation étant exclus. 132 patients ont été inclus, 74 eurent une échocardiographie et 58 n'en ont pas eu. La médiane de la durée de séjour était de 11,50 jours [8.00, 18.00], 12.50 jours [8.00, 22.00] dans la cohorte avec ETT et 9 jours [7.00, 15.00] pour ceux n'ayant pas bénéficié d'ETT ($p = 0.046$). L'analyse multivariée confirme la durée de séjour plus longue dans le groupe avec ETT avec $p = 0.043$. Elle est également significativement plus longue dans le groupe avec un syndrome de désadaptation psychomotrice, $p = 0.011$. Plusieurs facteurs peuvent influencer la durée de séjour, surtout dans une population gériatrique, ne le rendant pas fiable pour évaluer la qualité de prise en soins et donc de la qualité de vie.

Mots clés : ETT, décompensation cardiaque, gériatrie

Jury :

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Membres du Jury :	Professeur Anne BERNARD
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