

Research Article

Place of the scintigraphy imaging in French-speaking Black African cardiological practice

Adambounou K^{1,2}, Bakpatina-Batako D³, Adigo AMY¹, Bathily EAL², Yayehd K³, Achy OB⁴, Amoussou-Guenou KM⁵, Mbodj M², Tapsoba TL⁶ and Seck-Gassama S²

¹Service d'Imagerie Médicale, CHU Campus de Lomé 05BP 633, Lomé-Togo

²Service de Médecine Nucléaire HOGGY, Dakar-Sénégal

³Service de Cardiologie, CHU de Lomé, Togo

⁴Service de Médecine Nucléaire CHU de Cocody, Abidjan-Côte d'Ivoire

⁵Laboratoire de Biophysique et Médecine Nucléaire-Université d'Abomey Calavi, Cotonou-Benin

⁶Service de Médecine Nucléaire CHU YO, 03 BP 7022, Ouagadougou 03, Burkina-Faso

Abstract

Aim: To estimate the place of the scintigraphy imaging in French-speaking black African cardiological practice.

Materials and methods: Cross-sectional study conducted from February 1st till May 30th, 2017 including 97 cardiologists practicing in French-speaking black African countries. The accessibility and the frequency of prescription of the examinations of nuclear cardiology as well as the interest carried in these examinations by the cardiologists were analyzed.

Results: A department of nuclear medicine existed in their country, city and hospital of exercise respectively in 56.3%, 49.5% and 14.4% of the cases. A great majority of the cardiologists had never prescribed a myocardial perfusion scintigraphy (70.1%), of pulmonary perfusion scintigraphy (81.4%) and an multigated acquisition (MUGA) scan (94.8%). Only 5.2% of the cardiologists asserted prescribing often the myocardial perfusion scintigraphy and pulmonary scintigraphy and rarely the MUGA scan. The low frequency of prescription was connected with the rarity of the departments of nuclear medicine in 82.6% and with the weak diagnostic contribution in 8.2% of the cases.

The most sensitive examination for the diagnosis of the ischemia or the myocardial infarction was coronarography according to 66% of them and myocardial scintigraphy according to 26.8%. In the evaluation of the left ventricle function, 64.9% considered that the echocardiography is the satisfactoriest against 35.1% for the MUGA scan. To eliminate a pulmonary embolism in front of a normal thoracic radiography only 14.4% would ask for a pulmonary perfusion scintigraphy.

Conclusion: The place of the scintigraphy imaging is unsatisfactory in French-speaking black African cardiological practice and a raising awareness of the cardiologists on the diagnostic interest and forecasts of the nuclear cardiology is imperative so that it occupies its special place.

Introduction

Scintigraphic imaging regroup medical imaging diagnostical means based on unsealed radioactive source in vivo. It depends on a medical specialty called nuclear medicine which principal action field, a part from a minor therapeutic aspect, concerns the diagnosis, the prognostic and the therapeutic monitoring of a great number of pathologies throughout two major types of exams: the scintigraphies (or SPECT for Single Photon Emission Computed Tomography) and the Positron Emission Tomography (PET).

Developed since 1950's, following the discovery of artificial radioactivity by Irène and Frédéric Joliot-Curie [1] nuclear medicine noticed various clinical applications and nowadays is inescapable in many pathologies care especially cancerous, osteo-articular and cardiological.

Nuclear cardiology, that is its clinical application in cardiovascular pathologies, has acquire these past 30 years an essential place in cardiological practice in developed countries [2]. Thus, in USA, heart scintigraphic imaging exams are the most frequently performed in nuclear medicine departments with an annual frequency estimated to 10.3 million exams or 55.4% of the whole nuclear medicine exams performed in 2006 [3]. In France, nuclear cardiology comes in the

2nd rank and represent 24.4% of nuclear medicine acts according to a national survey in nuclear medicine made in the public sector in 2007 [4].

The incidence of cardiovascular pathologies is continuously increasing in developing countries with a growing morbidity and mortality but rare are the studies consecrated to isotopic exploration of cardiovascular pathologies in Black Africa particularly French-speaking [5,6].

It is in that prospect that we undertook that work which general objective was to evaluate the place given to scintigraphic imaging by cardiologist in their daily practice in French-speaking Black Africa.

Correspondence to: Adambounou Kokou, Service d'Imagerie Médicale, CHU Campus de Lomé 05BP 633, Lomé-Togo, Tel: 00228 90191633; E-mail: kadambounou@yahoo.fr

Key words: scintigraphy, nuclear cardiology, cardiac pathology, medical imaging, French-speaking Black Africa.

Received: September 04, 2017; **Accepted:** September 25, 2017; **Published:** September 29, 2017

Materials and methods

It is a cross-sectional study conducted from February 1st till May 30th, 2017 including 97 cardiologists practicing in French-speaking black African countries in public health facility as such as private one. Were not included in the study French-speaking black African cardiologists practicing in Europe or in a non-French-speaking black African country.

The parameters analyzed were:

- the identity (nationality, country of practice, health facility of practice, country of general practice training and specialization, training course in Europe, professional experience);
- the accessibility and the frequency of prescription of the main nuclear cardiology exams;
- the interest carried in these exams for cardiovascular pathologies exploration.

These parameters help us conceive a survey questionnaire made essentially of multiple choice questions (MCQ).

The data were analyzed with the statistic software Sphinx® 5.3.1. The qualitative data were treated with Microsoft Word® 2013 and the graphics with Microsoft Excel® 2013. The results were tested with Khi 2 test. All the differences inferior to 0.05 were considered significant.

Results

General characteristics of the cardiologists

Our sample was made of 97 cardiologists of various nationalities practicing in 9 different French-speaking black African countries in the majority in West Africa (91.2%) with Senegal, Togo, Burkina-Faso and Côte d'Ivoire as principal countries of practice (Table 1).

Forty-two cardiologists or 84.5% practiced in a public health facility and 15.5% in private.

Figure 1 shows that Senegal, Togo and Burkina-Faso were respectively the 3 first countries of general practice training when specialization countries were led respectively by Senegal, Côte d'Ivoire and Mali.

Thirty-five of them or 36.1% have been through a hospital training course in Europe.

Their professional experience was less than 5 years in 56.7% of the cases, comprise between 5 and 10 years in 32% of the cases and above 10 years in 12.3% of the cases.

Accessibility and frequency of prescription of nuclear cardiology exams in French-speaking Black Africa

The majority of the cardiologists (56.3%) had a department of nuclear medicine in their country of practice, about half of them (49.5%) had it in their town of practice and only 14.4% in their health facility of practice (Table 2).

Table 3 shows a weak frequency of prescription of nuclear cardiology exams with a great majority of cardiologist that has never prescribe a myocardial perfusion scintigraphy, a pulmonary perfusion scintigraphy and an multigated acquisition (MUGA) scan. This table reveals also that only 5.2% of the cardiologists have often prescribed myocardial perfusion and pulmonary perfusion scintigraphy but rarely the MUGA scan.

Table 1. Distribution of the cardiologists according to their nationality and their countries of practice.

	Nationality		Country of practice	
	Number	%	Number	%
Beninese	10	10.3	10	10.3
Burkinabe	14	14.4	14	14.4
Ivorian	6	6.2	12	12.4
Malian	8	8.2	8	8.2
Nigerien	8	8.2	9	9.3
Senegalese	19	19.6	20	20.6
Chadian	2	2.1	1	1.0
Togolese	17	17.5	16	16.5
Cameroonian	12	12.4	7	7.2
Congolese	1	1.0	0	0
Total	97	100	97	100

Table 2. Distribution of the cardiologists according to the availability of a service of nuclear medicine in their country, city and health facility.

	Country of practice		Town of practice		Health facility of practice	
	Number	%	Number	%	Number	%
NMD*	55	56.3	48	87.3	14	25.5
No NMD	42	43.3	7	12.7	41	74.5
Total	97	100	55	100	55	100

*NMD : Nuclear Medicine Department

Table 3. Distribution of the main examinations of nuclear cardiology according to their frequency of prescription by the cardiologists.

	Myocardial scintigraphy		MUGA scan		Pulmonary scintigraphy	
	Number	%	Number	%	Number	%
Never	68	70.1	92	94.8	79	81.4
Rarely	24	24.7	5	5.2	13	13.4
Often	5	5.2	0	0.0	5	5.2
Total	97	100	97	100	97	100

The prescription of myocardial scintigraphies was more regular (with a difference statistically significant $p < 0.05$) in cardiologists whose professional experience was comprised between 5 and 10 years, that have been through a training course in Europe and those practicing in countries with a nuclear medicine department such as Burkina-Faso, Niger and Senegal (Table 4).

The weak frequency of prescription of scintigraphic exams was related to the rarity of nuclear medicine departments in French-speaking black Africa by 80 cardiologists (82.6%), to a lesser specificity of scintigraphic imaging by 8 cardiologists (8.2%), to a small diagnostic contribution by 8 cardiologists (8.2%) and to a high dose of irradiation according to one cardiologist (1%).

Interest carried in scintigraphic exams in cardiovascular pathologies exploration by cardiologists in French-speaking Black Africa

Among Doppler echography, myocardial scintigraphy and coronarography, 4/5 of the cardiologists estimated that the coronarography is the best to explore coronary failure against only 1/5 for myocardial scintigraphy; the most sensitive exam for the diagnosis of myocardial infarction is the coronarography for 2/3 of the cardiologists against 1/4 for the myocardial scintigraphy (Table 5).

In evaluating ventricular function, 63 cardiologists (64.9%) estimated that Doppler echocardiography is the most satisfying against 34 cardiologists (35.1%) for MUGA scan.

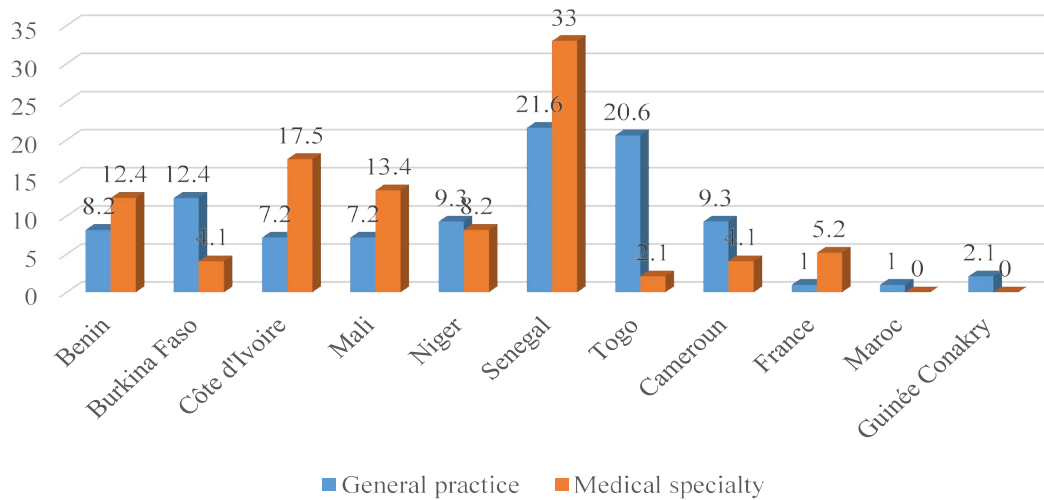


Figure 1. Distribution of the cardiologists according to their medical training countries (General practice and Specialty).

Table 4. Distribution of the cardiologists having never prescribed a myocardial perfusion scintigraphy, MUGA scan and pulmonary scintigraphy according to their professional experience, their participation in a training course in Europe or not and their country of practice.

	Myocardial scintigraphy			MUGA scan			Pulmonary scintigraphy		
	Number	%	p	Number	%	p	Number	%	p
Professional experience in cardiology			0.006			0.7			0.602
Less than 5 years	46	83.6		53	96.4		46	83.6	
5-10 years	15	48.4		29	93.5		23	74.2	
More than 10 years	7	63.6		10	90.9		10	90.9	
Hospital training course in Europe			0.000			0.035			0.102
Yes	18	51.4		33	94.3		26	74.3	
No	50	80.6		59	95.2		53	85.5	
Country of practice			0.014			0.774			0.08
Benin	5	50		9	90		7	70.0	
Burkina Faso	6	42.9		14	100		9	64.3	
Côte d'Ivoire	11	91.7		11	91.7		10	83.3	
Mali	8	100		8	100		7	87.5	
Niger	5	55.6		8	88.9		4	44.4	
Senegal	12	60		18	90		19	95.0	
Chad	1	100		1	100		1	100.0	
Togo	14	87.5		16	100		16	100.0	
Cameroun	6	85.7		7	100		6	85.7	

Table 5. Medical imaging examination more indicated for coronary failure and the most sensitive for myocardial infarction.

	More indicated for coronary failure		Most sensitive for myocardial infarction	
	Number	%	Number	%
Cardiac Doppler echography	3	3.1	7	7.2
Myocardial scintigraphy	19	19.6	26	26.8
Coronarography	75	77.3	64	66.0
Total	97	100	97	100

With an equal accessibility, to eliminate a pulmonary embolism in front of a thoracic pain with a normal thoracic radiography, about 4/5 of the cardiologists would ask for a thoracic angioscan against a little more than 1/10 for pulmonary perfusion scintigraphy (Figure 2).

The unavailability of nuclear cardiology exam was a major barrier in the daily cardiological practice according to 63 cardiologists (64.9%), minor for 29 (29.9%) and negligible for the 5 others (5.2%).

Sixty-nine cardiologist or 62.9% estimated to be able to recognize a typical image of myocardial ischemia.

Discussion

We have collected 97 cardiologists practicing in 9 French-speaking countries in Black Africa in majority of West Africa. This sample, though it has not included all the French-speaking countries of Black Africa, is representative of French-speaking black African cardiologists as it includes the majority of black African countries having French as the only official language.

Senegal was the first country of origin, practice and training in general practice as well as in specialization of the cardiologists of our study. This situation can be explained by the fact that Senegal, one of the greatest country of Africa, has the oldest Medicine Faculty of French-speaking West Africa and one of the most developed in French-speaking Africa talking of specialized medical training. The opening these 10 past years of Specialized Studies Degree (SSD) in cardiology in most of the practice countries of our sample making easier the

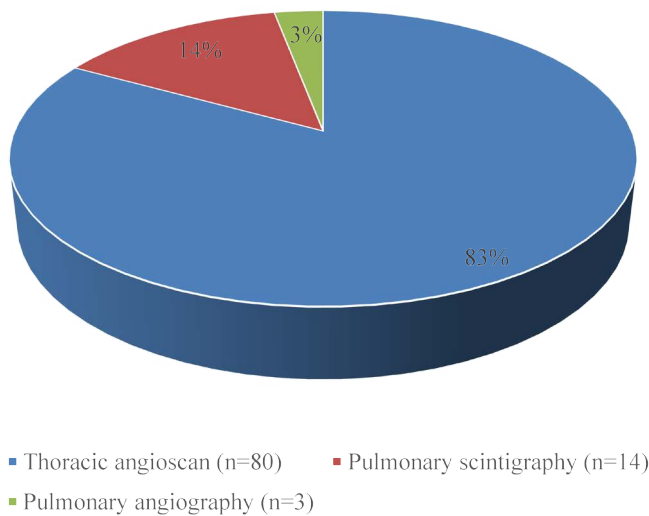


Figure 2. Medical imaging examination the most indicated to eliminate a pulmonary embolism in front of a thoracic pain with normal thoracic radiography.

medical specialization in cardiology could explain the important part of cardiologist with less than 5 years of experience in our study.

Nuclear medicine, medical imaging specialty complementary to radiology is unfortunately less developed in Africa where some countries of our sample like Togo, Benin, Chad do not have a nuclear medicine department, that explain that about 46% of the cardiologists of our sample practiced in a country where scintigraphic imaging is not accessible.

In the countries where scintigraphic imaging is available, nuclear medicine department does exist only in the capital and in only one hospital center justifying the weak percentage (14.4%) of cardiologists practicing in health facility with a nuclear medicine department.

The main isotopic explorations in cardiology are myocardial perfusion scintigraphy which acquisition is planar or more often tomographic (tomoscintigraphy), the scintigraphy of cardiac cavities also called MUGA scan and the pulmonary scintigraphy perfusion classified among the explorations of nuclear cardiology because of its capital interest in the exploration of pulmonary embolism which care is often performed by cardiologists.

Our work reveals a weak frequency of prescription of nuclear cardiology exams with a great majority of cardiologists that has never prescribed neither a myocardial perfusion scintigraphy, a MUGA scan nor a pulmonary perfusion scintigraphy. This situation is a bit regrettable knowing the important role that plays scintigraphic imaging beside the other medical imaging techniques in cardiovascular pathologies care [7].

Nuclear cardiology has an important part in nuclear medicine departments in USA where, according to a study published by Mettler [3], its frequency went from 12.800 acts in 1982 to 9.800.000 acts in 2005 to reach 10.300.000 acts in 2006 becoming then the most performed scintigraphic imaging far before bone scintigraphic imaging occupying the second place with 3.620.000 acts. In France, the nuclear cardiology acts can be estimated to more than 150.000 per year according to the national survey on nuclear medicine of 2007 [8]. The frequency of prescription of myocardial scintigraphy was the most regular in our study confirming the literature that consecrate myocardial scintigraphy as the principal scintigraphic imaging asked by cardiologists in

developed as well as developing countries [7]. It comes out too from our study that the cardiologists practicing in countries with a nuclear medicine department such as Burkina-Faso and Niger have prescribed more regularly scintigraphic imaging than their colleague of the other countries, that is encouraging. In Burkina-Faso, according to a study published by Tapsoba [9], the nuclear cardiology exams with 22.2% of the nuclear medicine acts performed in the 6 first months of working of the nuclear medicine department of Yalgado Ouedraogo Teaching Hospital occupied the 3rd place talking about frequency behind bone scintigraphy (38.9%) and thyroidal (29.2%). In Niger, according to Tahirou [10], 37 myocardial scintigraphies or 13.9% of nuclear medicine exams were performed from January 1st to March 31st, 2011.

The frequency of prescription more regular in cardiologists with 5-10 years of professional experience and those who have been through a training course in Europe augur that a better place will be given to scintigraphic imaging in the coming years in French-speaking Black Africa. Moreover, the justification in 82.6% of the rarity of nuclear medicine exams prescription by a penury of nuclear medicine departments actually in our developing countries let us believe in a more frequent and more regular prescription of cardiological scintigraphic exams in proportion as their availability in our countries and hospitals will grow. It comes to health authorities of the French-speaking black African countries to invest more in the development of nuclear medicine to improve the accessibility of scintigraphic imaging for a better care of patients.

But beyond the accessibility of nuclear medicine department, a judicious knowledge by cardiologists of the real interest of the main nuclear cardiology exams in cardiovascular pathology exploration is essential for scintigraphic imaging to occupy its special place beside the other imaging techniques in cardiological practice in Black Africa.

Thus, myocardial perfusion scintigraphy, main exam in nuclear cardiology, permit the evaluation of the relative myocardial perfusion (rest and or stress) through the intravenous administration of a radiopharmaceutical drug and this way, permit to detect territories having a relative deficit of fixation and then of myocardial perfusion (myocardial ischemia and myocardial infarction). It is a key-exam in coronaropathies managing, for initial diagnosis as well as for prognostic evaluation and help for therapeutic decision [11]. A recent meta-analysis led on 33 studies has showed a global sensitivity of 87%, a specificity of 73% at a normality rate of 91% [12]. It is then encouraging to notice that in our study, cardiologists are more numerous preferring myocardial perfusion to cardiac Doppler echography in the exploration of coronary failure and in the precocious diagnosis of myocardial infarction.

On the other hand, a great majority of cardiologist have estimated that coronarography is better indicated than scintigraphy in the exploration of coronary failure and is more sensitive than scintigraphy in the diagnosis of myocardial infarction. Even it is true that coronarography is still considered as the reference-exam in coronaropathy, we should underline that it is an invasive exam then riskier and expensive than myocardial scintigraphy. Talking of prognostic, the evidences of myocardial scintigraphy interest are extremely strong, either in suspected patients or already known coronary disease patients [13]: a normal myocardial perfusion scintigraphy gives a three and five years' excellent cardiovascular prognostic and so the mortality is stackable to the mortality of a same normal population (in average 0.6% per year). Inversely, more the defect is spread in the perfusion scintigraphy and more the cardiovascular prognostic is severe [14]. The myocardial

perfusion scintigraphy has also the advantage to be coupled to the ECG allowing then to study the cardiac parietal kinetic.

The MRI occupies a more and more increasing place in the coronaropathy exploration and has the advantage to be non-irradiant. But it is very expensive cost, its weak accessibility even in some developed countries such as France, pleads its disfavor in particular in our developing countries. The scintigraphy, less expensive than the MRI, coronarography and even the coronaro-scanner in Africa where patients financial means are very limited, is no more necessary to remind.

It is also important to underline the emergence these past years in western countries of the Positron Emission Tomography (PET) in cardiac pathologies exploration that comes to remedy some limits of myocardial perfusion tomoscintigraphy and we can suppose that myocardial perfusion imaging will represent an important part of cardiological activity in PET the coming years.

It is all the more probable that beside the diagnosis of coronary failure, for which the attenuation correction and the absolute quantification of myocardial blood flux represent major advancements, the perfusion can be associated to the study of glycolytic metabolism through the 18F-dexoyglucose (FDG) within the context of seeking for myocardial viability or to the study of the innervation in the prognostic evaluation of cardiac failure [15].

In the evaluation of the ventricular function, 64.9% of the cardiologists have estimated that the cardiac echography was more satisfying than MUGA scan. This result, even if it is questionable, shows an unawareness of the real interest of the MUGA scan that, because of its easiness in acquisition and its high reproducibility, stays actually one of the reference methods in accessing the left ventricular ejection fraction (LVEF), permitting to underline its feeble variations [16,17].

The pulmonary embolism is an emergency frequently took in charge by cardiologists. The scintigraphic imaging represented by the pulmonary perfusion scintigraphy is the non-invasive reference-exam for the diagnosis of pulmonary embolism with a great sensitivity in front of a thoracic pain with normal thoracic radiography. A normal pulmonary perfusion scintigraphy eliminates with certitude the diagnosis of pulmonary embolism in this case. Unfortunately, about 4/5 of the cardiologists of our sample would ask for a thoracic angioscan against only a little more than 1/10 for pulmonary perfusion scintigraphy in such a clinical situation. This result is a bit regrettable especially if we consider that except the diagnosis performance of the pulmonary perfusion scintigraphy, it is less irradiant than the thoracic angioscan that delivers an average dose of 15mSv against 1mSv for the pulmonary perfusion scintigraphy [18].

Conclusion

Cross-sectional study on the place of scintigraphic imaging in French-speaking black African cardiological practice, it has permitted us to realize that nuclear cardiology exams are weakly prescribed. Perfusion scintigraphy was the more regularly scintigraphic imaging prescribed. The feeble prescription of scintigraphic exams linked to the penury of nuclear medicine department by the majority of the cardiologists is also accentuated by the lack of interest of cardiologists for scintigraphic imaging comparatively to the other techniques of medical imaging in the care of their patients. A sensitization of cardiologists on the diagnostic and prognostic real interest of nuclear cardiology exams in cardiovascular pathologies exploration seems necessary so that scintigraphic imaging occupies its special place beside

the other techniques of medical imaging in French-speaking black African cardiological practice.

Conflict of interest

None

References

1. Wagner HN (2006) A Personal History of Nuclear Medicine. Springer.
2. Lévy M (2012) Cardiologie nucléaire. *EMC-Cardiologie* 4568: 38506-9.
3. Mettler FA Jr, Bhargavan M, Faulkner K, Gilley DB, Gray JE, et al. (2009) Radiologic and nuclear medicine studies in the United States and worldwide: frequency, radiation dose, and comparison with other radiation sources--1950-2007. *Radiology* 253: 520-531. [[Crossref](#)]
4. Roch P, Aubert B (2012) Le point sur les niveaux de référence diagnostiques en médecine nucléaire en 2011. *Méd Nucl* 36: 378-389.
5. Bertrand E (1997) Évolution épidémiologique des maladies cardiovasculaires dans les pays en développement. *Arch Mal Coeur Vaiss* 90: 981-5.
6. Tapsoba TL, Lougué L, Ouattara TF, Ouédraogo SJ, Sanon H, et al. (2012) Place de la scintigraphie myocardique dans le bilan des pathologies cardiaques au centre hospitalier universitaire Yalgado Ouédraogo (CHU-YO) : à propos de 73 cas colligés d'avril. *Méd Nucl* 39S: e47-e54.
7. Pomin M (2004) Actualités en cardiologie. *EMC-Cardiologie Angéiologie* 1: 177-186.
8. Étard C, Aubert B (2012) Enquête nationale en médecine nucléaire : radiopharmaceutiques et activités utilisés en 2007 dans le secteur public *Méd Nucl* 36: 53-61.
9. Tapsoba TL, Sanon H, Ouattara TF, Ouédraogo SJ, Gansonré KV (2012) Bilan des six premiers mois de fonctionnement du service de médecine nucléaire du centre hospitalier universitaire Yalgado Ouédraogo. *Méd Nucl* 36: 514-517.
10. Tahirou I, Moussa IDJ, Ada A, Djeomboro I, Moustapha A, et al. (2012) Analyse des résultats préliminaires de scintigraphie myocardique réalisée à l'institut des radio-isotopes (IRI) du Niger: à propos de 37 cas. *Méd Nucl* 622:9.
11. Calizzano A (2007) Place actuelle et perspectives futures de la scintigraphie de perfusion myocardique. *Méd Nucl* 31: 604-609.
12. Klocke FJ, Baird MG, Lorell BH, Bateman TM, Messer JV, et al. (2003) Guidelines for the clinical use of cardiac radionuclide imaging-executive summary: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (ACC/AHA/ASNC Committee to Revise the 1995 Guidelines for the Clinical Use of Cardiac Radionuclide Imaging). *Circulation* 108: 1404.
13. Marcassa C, Bax JJ, Bengel F, Hesse B, Petersen CL, et al. (2008) Clinical value, cost-effectiveness, and safety of myocardial perfusion scintigraphy: a position statement. *Eur Heart J* 29: 557.
14. Machecourt J, Vanzetto G, Fagret D (2008) Dépistage de l'ischémie myocardique. L'avis du clinicien. *Méd Nucl* 32: 431-438.
15. Rouzet F, Hyafil F, Leygnac S, Ben Azouza R, Sorbets E, et al. (2012) La tomographie par émission de positons en cardiologie. *Méd Nucl* 36: 438-444.
16. Corbett JR, Akinboboye OO, Bacharach SL, Borer JS, Botvinick EH, et al. (2006) Equilibrium radionuclide angiocardiography. *J Nucl Cardiol* 13: e56-79.
17. Mitra D, Basu S (2012) Equilibrium radionuclide angiography: its use-fulness in current practice and potential future applications. *World J Radiol* 4: 421-30.
18. de Broucker T, Pontana F, Santangelo T, Faivre JB, Tacelli N, et al. (2012) Single- and dual-source chest CT protocols: Levels of radiation dose in routine clinical practice. *Diagn Interv Imaging* 93: 852-8.

Copyright: ©2017 Adambounou K. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.