



RESEARCH ARTICLE

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## EVALUATION OF BRADYCARDIA IN SUB-SAHARAN AFRICA: THREE CASE SERIES AND CHALLENGES IN MANAGEMENT

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### ABSTRACT

Symptomatic bradycardia is a commonly observed arrhythmia in sub-Saharan Africa. It may result from sinus node, atrioventricular (AV) nodal tissue, and the specialized His-Purkinje conduction system. Assessment of symptoms is critical in the evaluation and management of bradycardia. In these 3 case series, we focus on the challenges in management.

**Key Words:**

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## INTRODUCTION

Arrhythmia refers to deviation from the normal physiologic heart rhythm (Pons, 2017). Bradycardia is heart rate less than 50bpm (Kusumoto, 2018). Bradycardia could be sinus or ectopic. Pathophysiologically, bradycardia may result from dysfunction of the Sinus Atrial Node, Atrio-Ventricular Node, or the degeneration of the conduction pathway (Kusumoto, 2018). In patients with suspected bradycardia or conduction disorders a comprehensive history and physical examination should be performed (Kusumoto, 2018). It is crucial to establish the correct diagnosis and note its cause as either permanent or temporary as the treatment may be required for symptomatic patients. The objective of this study was to discuss three case series and challenges in management in a Sub-Saharan African center.

### Case 1

Mr NP is a 77 year old Man, living with hypertension for 20 years. He presented with palpitation of 4 months duration. He was in his usual state of health until 4 months prior to

presentation when he developed palpitation. It was irregular in pattern, each episode last for 30-40 minutes, sometime, up to 1 hour. He has 7-8 episode per day. There was associated history of pre-syncope and syncope attack. No history of cough, fever, paroxysmal nocturnal dyspnea, orthopnea and no leg swelling. No history of headache, limb weakness and no change in bowel habit. No history of abdominal pain and diarrhea. He is not living with Diabetes Mellitus or Asthma. Examination showed elderly man conscious alert not in respiratory distress afebrile 36.5°C, not pale anicteric, acyanosed, no significant peripheral lymph node enlargement no finger clubbing, no pedal edema no asterixis. Pulse 40 bpm irregular irregular, blood pressure 180/80mmHg, jugular vein pressure was 5 cmH<sub>2</sub>O. Apex beat was at 5<sup>th</sup> left intercostal space, lateral to mid-clavicular line, with heart sounds S<sub>1</sub> and S<sub>2</sub>. Chest examination showed vesicular breath sound. The abdominal and neurologic examinations were essentially normal. Assessment of hypertensive heart disease with atrial fibrillation and slow ventricular response was made. Our plan was to admit the patient to the Intensive Care Unit, and the following medication was administered: Atropine 0.5mg 6

hourly up to 3mg, oral amlodipine 5 mg daily and oral telmisartan 40mg daily. The first admission was for the pacemaker insertion was postponed due to inability to finance the procedure. We requested for the following investigations

- **Electrocardiography:** it showed atrial fibrillation with slow ventricular response.
- **24 hours Holter monitor:** It showed Bradycardia at 35-48 bpm, R-R Pulse of 4.6 sec atrial fibrillation with complete heart block and slow ventricular response (Figure 1)



Figure 1.

- **Echocardiography:** This showed concentric hypertrophy with normal ejection fraction (Figure 2).

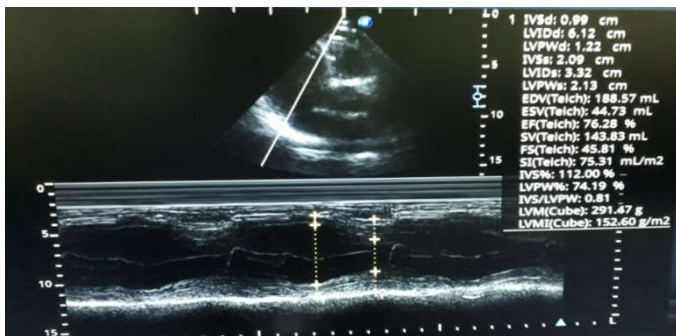


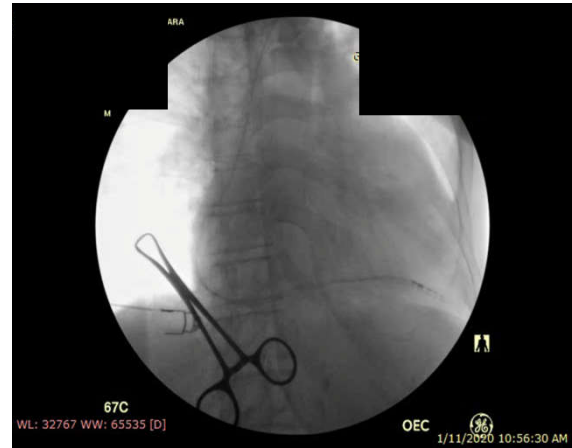
Figure 2. Parasternal long axis showing the 2-D and the M-mode echocardiography

- The laboratory results is showed as bicarbonate ( $\text{HCO}_3^-$ ) 22mmol/l, Sodium ( $\text{Na}^+$ ) 130mmol/l, potassium ( $\text{K}^+$ ) 4.1mmol/l, Urea 3.5mmol/l, creatinine (Cr) 72umol/l

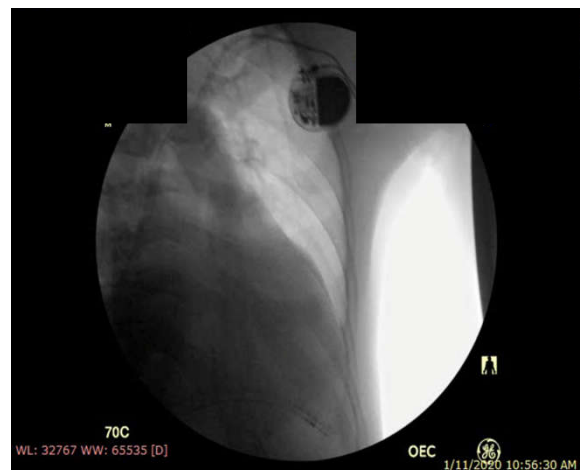
As at the second day of admission, the diagnosis was symptomatic bradycardia with atrial fibrillation and slow ventricular response at a pulse rate of 30bpm. He was counseled on urgent need of Single chamber pacing to the right ventricle with VVIR Mode. The pre-procedure preparation was stated with explaining VVIR pacemaker, informed consent and part preparation of both shoulder region. IV ceftriaxone 1 gram was given 2 hours before the procedure.

**Procedure:** Access was via the left shoulder below the clavicle in aseptic technique. Tumescant anesthesia consisting of 2% lidocain, Bupivacaine and normal saline in the ration of 15:10:5 respectively. The was created after local tumescant anesthesia was given. The pocket was created via transverse incision taken at 2 cm below the left clavicle. The incision was

dissected along the plane of whitish fascia over the Pectoris Major until the pocket was created. The next step was to gain access through the left subclavain vein. This was followed with placement of pill off 7F sheath and right ventricular lead position (CapSureFix Novus MRI SureScan, SN: PJN9084951, REF: 5076-58). The following parameters were checked with threshold 0.4volts, impedance 560 ohms, R-wave 15.2 volts, and diaphragmatic pacing was nil. The pulse generator (SENSIA, SEDR01, SN: NWL427590G) was connected to the lead and screwed. The pocket was closed (Figure).



a



b

Figure 3. a and b: VVIR pacing

**Discharge and Follow up:** He was in the hospital for 3 days post operation. Intravenous ceftriaxone 1 gram daily for 3 days, wound dressing was changed on the 3rd day post up. Continue oral anti-hypertensive (amlodipine 5 mg daily and telmisartan 40 mg daily) and wound dressing on alternate day from home. The implanted device was agreed to be paid installmently over a period of one year.

## Case 2

Mrs GB, 68 year old female, living with diabetes mellitus for 20 years, hypertension for 10 years and Dyslipidemia for 4 years. She was in his usual state of health until 6 months before presentation when he developed dizziness and syncopal attack. This has progressively increased from 2-3 episode per day to 4-5. There is associated history of cough, paroxysmal nocturnal dyspnea, orthopnea, fatigue. She was initially

diagnosed with heart complete heart block 2 months ago, but did not proceed with further evaluation due to financial distress. Examination revealed elderly man not in any obvious distress, not pale afebrile, anicteric acyanosed, no pedal edema. Weight=82kg, height=168cm, body mass index (BMI) 29kg/m<sup>2</sup> Cardiovascular examination= pulse 20 bpm regular, blood pressure 162/86mmHg, Heart sounds S4, S1,S2. Initial assessment of biventricular failure secondary to symptomatic complete heart block was made. She was admitted to the intensive care unit and counseled for dual chamber pacemaker implantation. The following investigations were done. These include:

1). Electrocardiography: it showed complete heart block as shown in Figure 4.

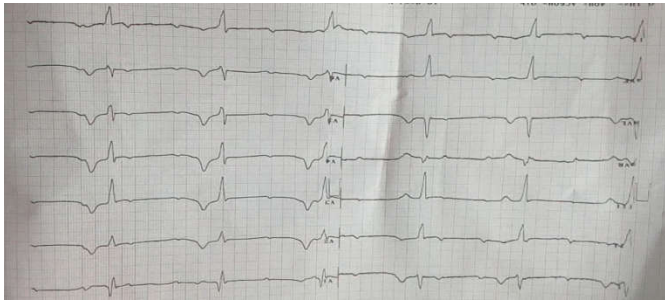
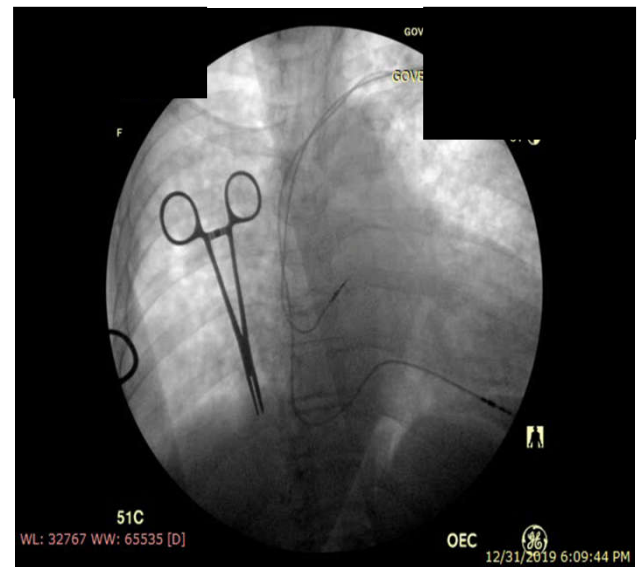


Figure 4. Complete heart block with rate of 35bpm

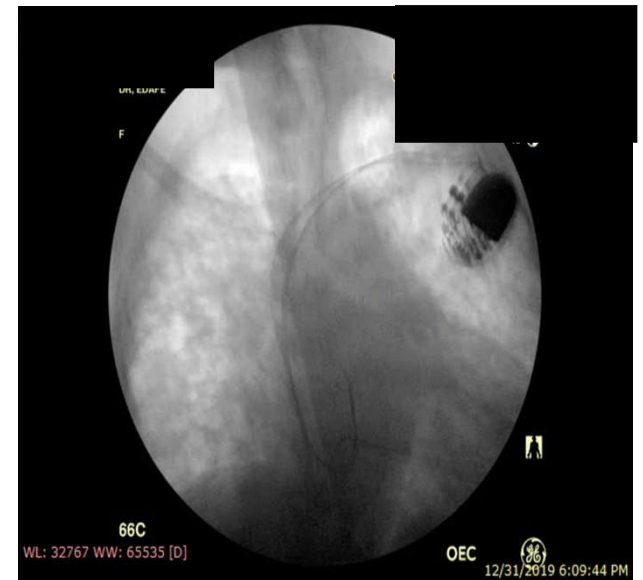
**Laboratory investigation:** Hemoglobin 11.5g/dl, Sodium 140mmol/l, potassium 4.1mmol/l, urea 3.9mmol/l, creatinine 54ummol/l. emergency dual chamber pacemaker was plan for her. The pre-procedure preparation was stated with explaining DDIR pacemaker, informed consent and part preparation of both shoulder region. Intravenous ceftriaxone 1 gram was given 2 hours before the procedure.

**Procedure:** Access was via the left shoulder below the clavicle in aseptic technique. Tumescant anesthesia consisting of 2% lidocain, Bupivacaine and normal saline in the ration of 15:10:5 respectgively. The was created after local tumescant anesthesia was given. The pocket was created via transverse incision taken at 2 cm below the left clavicle. The incision was dissected along the plane of whitish fascia over the Pectoris Major until the pocket was created. The next step was to gain access through the left subclavain vein. This was followed with placement of pill off 7F sheath and right ventricular lead position (CapSureFix Novus MRI SureScan, SN: PJJN7699944, REF: 5076-58). The following parameters were checked with threshold 0.5volts, impedance 820 ohms, R-wave 11.2 volts, and diaphragmatic pacing was nil. The right atrial lead (CapSureFix Novus MRI SureScan, SN:PJJN9287525, REF:5076-52)was positioned. The ventricular and atrial leads were connected to the Pulse Generator (ENSURA DR MRI SureScan ENIDR01, SN:PZW103595G). This is shown in Figure 5.

**Discharge and follow up:** She was in the hospital for 3 days post operative. She continued the Intravenous ceftriaxone 1 gram daily, wound dressing was changed on the 3rd day post operation, continue oral anti-diabetic medication and statin. She was discharged home on the third day. She was having wound dressing on alternate day from home. The cost of the pacemaker was paid over 4 months.



a



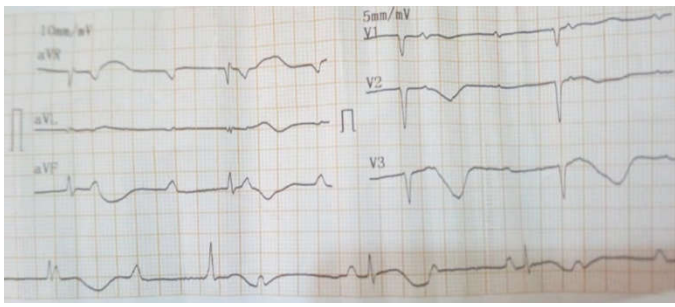
b

Figure 5a,b. dual chamber pacemaker. The right ventricular lead goes to the apex

### Case 3

A 68 years old woman living with diabetes and hypertension for 20 years. She presented to the emergency room with 3 weeks history of syncopal attack and intermittent loss of consciousness. No history of palpitation and chest pain. She was taken to the spiritual prayer house for 5 days. She was brought to the emergency room of the Bayelsa Specialist by her son. She resides in the village that is 3 hours way from the Bayelsa Specialist Hospital. She was diagnosed with symptomatic bradycardia 12 months ago but Declined further management due to financial constrain. At presentation, she not conscious, afebrile, anicteric, no leg edema. Pulse was 18bpm, blood pressure was 110/70mmHg, and Heart sounds were S1 and S2 only. The central nervous system examination showed Glasgow Coma Scale of 10 (Eye opening 4, Verbal Response 3, Motor response 3), generalized hypotonia and hyporeflexia. The electrocardiogram showed complete heart block (figure 6). His Na<sup>+</sup>=132mmol/l, K<sup>+</sup>=3.0mmol/l, urea=7.3mmo/l and creatinine=112ummol/l.





**Figure 6. Complete heart block**

Informed consent was taken for dual chamber implantation. The procedure was explained to relatives. Intravenous ceftriaxone 1 gram was given 2 hours before the procedure.

**Procedure:** Informed consent was taken after explaining to the procedure to the patient. Patient skin was prepped with betadine solution. Tumescence anaesthesia (2% lidocaine, bupivacaine, and normal saline in 15:10:5 ratio respectively) was injected locally under the skin. The pocket was created with access obtained. The ventricular lead was positioned and tested for threshold, impedance and diaphragmatic stimulation (See table 1). The lead was screwed to the pulse generator. The pocket was closed (see Figure 7).

**Table A and B: showed the implant data.**

A

| parameter                      | ventricular |
|--------------------------------|-------------|
| threshold                      | 0.30 volts  |
| Impedance                      | 670 ohms    |
| R-wave                         | 14.2 volts  |
| Diaphragmatic test at 10 volts | nil         |

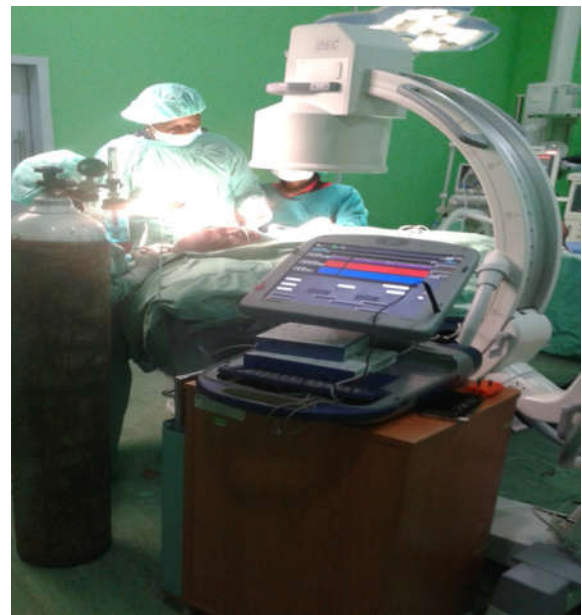
B

| Parameter     | Pulse generator | Ventricular lead  |
|---------------|-----------------|-------------------|
| manufacturer  | Medtronic       | Medtronic         |
| Name          | SENSIA          | CapSurreFix novus |
| Mode number   | SEDR01          | 5076-58           |
| Serial number | NWL434845G      | PJN9258868        |

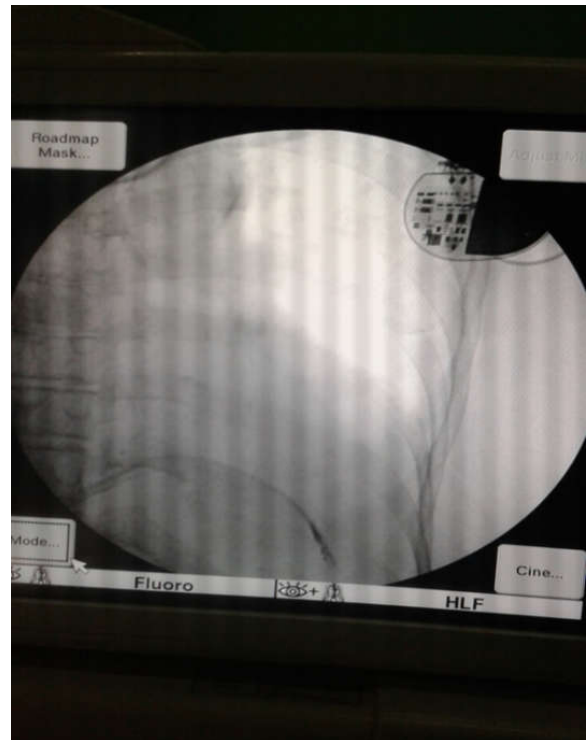
Discharge and follow up: She was in the hospital for 5 days post-operative. She continued the Intravenous ceftriaxone 1 gram daily, wound dressing was changed on the 5<sup>th</sup> day post operation, continue oral anti-diabetic medication and statin. She was discharged home on the fifth day. She was having wound dressing on alternate day from home. The cost of device and hospital stay was paid over 6 months.

## DISCUSSION

**Classification of bradycardia:** Bradycardia could be classified based on electrocardiography, electrophysiology, anatomical site of block, clinical presentation and the etiology (Gorenk, 2018). Based on the anatomical site, bradycardia may result from impulse formation disorder such as sinus arrest, chronotropic incompetence, brady-tachy syndrome or impulse conduction such as exit block, first, second third or high A-V block. Based on electrophysiology and electrocardiography, it may be narrow complex bradycardia such as supra-histal third degree A-V block; and wide complex bradycardia such as infra-histal A-V block (Gorenk, 2018).



A



B

**Figure 7 A and B: during the implant procedure B: the final image after implant procedure**

Based on clinical presentation, bradycardia may be symptomatic or asymptomatic. The two cases presented above had symptoms such pre-syncopal, syncopal attack and palpitation. The second patient also had symptoms of heart failure (Gorenk, 2018).

### Clinical signs and symptoms

Bradycardia rhythm as a sign requires the knowledge of the cardiac conduction system and the various electrocardiographic manifestations (Sidhu, 2019). Bradycardia may be associated with various differential diagnosis (Sidhu, 2019). These differentials may include the following: acute myocardial infarction, sepsis, hypoxia, drug, hypoglycemia, and hypothermia (Kusumoto, 2018). A

common cause of bradycardia is aged related fibrous degeneration of the conduction pathway which may manifest as sinus node dysfunction, various atrio-ventricular node blocks and non-specific conduction delay (Kusumoto, 2018). No symptom of bradycardia is specific (Sidhu, 2019). These symptoms could be seen in other disease entity. These symptoms include syncope, pre-syncope, transient dizziness or lightheadedness, fatigue, dyspnea on exertion, heart failure symptoms, confusion and palpitation (Voglent, 2012). The first case presented with palpitation, pre-syncope and syncopal attacks. The second case presented with dizziness, syncopal attack, paroxysmal nocturnal dyspnea and fatigue while the third case presented with features of heart failure. The history may include long duration before presentation. The first, second and third patients have symptoms lasting for 4, 6 and 12 months before seeking the expert of specialist care. The delay was due to finance to fund the procedure and hospital bills as patients pay from their pockets. The physical examination of the three cases revealed chronic features of hypertension i.e. thickened arterial wall, locomotor brachialis and heaving apex. Bradycardic patients present unique challenges to the physician working in the developing countries (Harrigan, 200). The first presentation may be with symptoms of heart failure, repeated seizures or loss of consciousness (Kusumoto, 2018). The presentation may be delayed due to lack of finance to pay hospital bill, misinterpretation of symptoms as spiritual attack by religious leaders, friends and relatives which is commonly seen in developing countries. This may force the patient to seek spiritual healing and will present at the terminal end of disease like heart failure or loss of consciousness from multiple seizures. So the clinician is challenged with ability to cope with resuscitation measures before proceeding with further evaluation and work-up of the bradycardia. The management of bradycardia is determined by the severity of symptoms, the degree of correlation between symptoms and confirmed bradycardia, and the presence of potentially reversible causes. There are few indications for intervention in patients with bradycardia who are truly asymptomatic (Kusumoto, 2018).

**Clinical Evaluation Challenges:** The health seeking behaviors (HSB) are closely linked with the health status of a state and thus it's economic development. There are several factors responsible for it and those in the lower socioeconomic class have more inappropriate HSB than members in higher classes. Patients seek different sources of health care from visits to Traditional Healers, Chemists, Churches, Mosques before visiting hospitals. Most patients with bradycardia present late to hospital only when symptomatic and usually with complications such as heart failure, syncope, sudden cardiac arrest and loss of consciousness.

**Investigations of bradycardia:** Investigations during evaluation of patients with bradycardia may include 12 lead electrocardiography (ECG), 24 hours Holter monitor, echocardiography and electrolytes (Kusumoto, 2018). The 12 leads ECG is the mainstay for evaluating rhythm disorders of the heart. The 12 leads ECG is affordable, noninvasive, minimal adverse effect, specific and portable. The 12-lead ECG may suggest structural heart disease and other cardiac conditions that may predispose patients to bradyarrhythmias. It may show sinus node dysfunction, and various types of atrio-ventricular conduction blocks. Ambulatory ECG monitoring may be employed in patients with suspected rhythm disorder but normal resting ECG. In our case 1, he has atrial fibrillation

seen with slow ventricular response, but on 24 hours Holter, additional R-R pause was additional diagnosis. Cardiac monitors such as telemetry, external loop recorder, implantable loop recorder, external patch may be required (Kusumoto, 2018). These are rarely used in sub-Saharan Africa. Cardiac Magnetic Resonance Images or Cardiac Computer Tomography may be required. But such test are rarely employed in sub-Saharan region.

**Investigation challenges:** Investigating the bradycardia patient may also be challenging as some patients may not be able to afford the cost, and many centers are also not well equipped. The 12 lead ECG is usually available but maintenance is a challenge, and the Holter monitor for ambulatory ECG monitoring is not readily available in many centers. The Computer Tomography (CT) angiogram is available only in very few centers, and quite expensive for our patients.

**Challenges in the Management of Bradycardia:** There are many challenges encountered while treating patients with symptomatic bradycardia in the sub-Saharan Africa. These include human resource, patient care and cost of procedure.

**Human Resources:** In Nigeria, there is limited number of well-trained qualified specialist nurses in cardiology, thus patients are cared for by non-specialist nurses. Over the past few years there has been rise in the number of technologists. Specialized training and creation of regional cardiology departments is still somewhat limited in Nigeria. Thus specialist qualified nurses and Interventional cardiologists is still very limited. This may force patients to travel long distance for treatment of symptomatic bradycardia.

**Challenges with Care of the patient:** Managing peri-procedural accidents like atrial lead dislodgement, lead rupture, cardiorespiratory arrest, cardiac tamponade due to right atrial perforation etc could be quite challenging as most centres are ill equipped and lack qualified trained personnel.

**Cost of procedure:** This is the most importance reason while patient get sub-optimal care. The patient or relatives fund their procedures with no insurance coverage. The National Health Insurance Scheme (NHIS) and the Health Maintenance Organization (HMO) do not cover these procedures in their list of health care. This makes it difficult for patients to pay since the device and the procedures are relatively expensive for the majority.

## Recommendations

The government of the region has a lot to do in making healthcare affordable to patient. There should be a policy to by government to cut down the cost of various devices used in the management and intervention for symptomatic bradycardia. The government could invite the device manufacturing companies to a round table meeting to work out a way to reduce cost for the sub-Sahara Africa region. Government should create soft landing for the device companies. This will make their product cheap accessible and affordable. Training of human resources locally and abroad for the use of these devices could be done by government and the companies. Government and device companies in conjunction with the private sector should fund research in the region into development of affordable devices for the population.

Regional government should set up a regulatory bodies to ensure implement and adherence of the policy for the growth of the cardiovascular health of the the sub-Sahara Africa.

### Conclusion

There are numerous challenges encounter in the evaluation and treatment of symptomatic bradycardia in sub-Saharan Africa. These challenges include:cost of device, care of patient and availability of human resource.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names will not be publishedand due efforts will be made to conceal their identity.

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**Conflicts of interest:** There are no conflicts of interest.

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