

liver function tests, renal function tests, serum electrolytes, urine routine examination, and chest x-ray were normal. Electrocardiogram (ECG) showed sinus bradycardia with sinus pauses (Figure 1).

His CT-scan of the brain was also done to rule out any central cause of his symptoms, but that was also normal. His thyroid function tests were also normal. Echocardiography was also normal with 60% ejection fraction. Considering sinus bradycardia and sinus pauses, a 24-hour Holter monitoring was done, which showed multiple sinus pauses with an average of 3.15 seconds (Figure 2).

So, keeping in view the typical presentation and investigations, our final diagnosis was sinus node dysfunction causing sinus pauses and leading to cardiogenic dementia.

Depending upon our diagnosis, we managed our patient with the implantation of a permanent pacemaker device (Figure 3). The whole procedure was done safely with good final results and with no complications. The patient's heart rate was set at 60 bpm and was permanent pacemaker-dependent. The patient was stable and discharged after 1 day post-procedure. After 2 weeks, the patient came for follow-up and he was reassessed and was well oriented with time, place, and person, and his family members told that his memory functioning has improved rapidly and he started doing his all chores by himself again. He was maintaining his vitals with a pulse rate of 60 bpm. His mini mental state examination had improved from 9/30 to



Figure 1. ECG showing sinus bradycardia with sinus pauses.



Figure 2. 24-hour Holter monitoring showing sinus pauses with an average of 3.15 seconds.

23/30. The patient was advised for follow-up interrogation of pacemaker.

Discussion

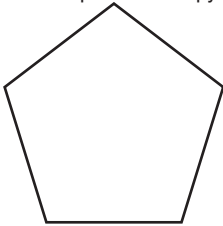
Our patient was finally diagnosed as case of sinus node dysfunction, revealing itself as sinus pauses and complicated

as progressive memory impairment. He was an old man in his early seventies with no established pre-morbids and presented with dizzy spells and memory impairment. His Holter monitoring showed sinus pauses of 3.15 seconds. To the best of our knowledge, most of the cases published, to date, showed that patients usually present with dizzy



Figure 3. Chest x-ray showing permanent pacemaker dual chamber-rate modulated pacing (DDD-R).

Table 1. Mini mental state examination of the patient.

ONE POINT FOR EACH ANSWER					BEFORE PPM	AFTER PPM
Orientation						
Year	Season	Month	Date	Time	2/5	5/5
Country	Town	District	Hospital	Ward/Floor	2/5	5/5
Registration						
Examiner names three objects (apple, table, and penny) and ask the patient to repeat (1 point for each correct. Then the patient learns three names repeating until correct)					2/3	3/3
Attention and calculation						
Subtract 7 from 100, then repeat the result. Continue five times: 100, 93, 86, 79, and 65. (Alternative: spell WORLD backwards: DLROW)					0/5	3/5
Recall						
Ask for the names of three objects learned earlier.					0/3	1/3
Language						
Name two objects (e.g., pen and watch)					1/2	2/2
Repeat “no, ifs, ands, or buts”					0/1	0/1
Give a three-stage command: score 1 for each stage.(e.g., hold the paper, fold it twice, and then put it on the table)					1/3	2/3
Ask the patient to read and obey a written command on a piece of paper. The written instruction is “close your eyes.”					1/1	1/1
Ask the patient to write a sentence. Score 1 if it is sensible and has a subject and a verb.					0/1	1/1
Copying						
Ask the patient to copy a pair of intersecting pentagons					0/1	0/1
						
Total					09/30	23/30

Ppm = permanent pacemaker.

spells and shortness of breath. Our patient had a distinct clinical presentation of memory impairment which improved rapidly after pacemaker implantation.

Heart diseases are the leading cause of significant morbidity and mortality worldwide, especially in the elderly [1]. Sinus node dysfunction and bradycardia are included in these diseases and are prevalent in the elderly population [2]. Increasing age is related to progressive idiopathic fibrosis of sinoatrial node and atrioventricular conduction system, which lead to sinus node dysfunction and bradycardia [5]. Common symptoms of sinus node dysfunction include dizziness, shortness of breath, easy fatigue-ability, and rarely memory impairment [1]. Bradycardia results in symptomatic cerebral hypoperfusion, especially in the elderly people [6]. The regulation of cerebral blood flow is significantly related with heart rate. Studies have shown that severe bradycardia results in the decline of cognitive functioning, especially in older people [7]. Vascular dementia can be described as the decline in thinking skills caused by cardiac conditions that block or reduce cerebral blood flow. Cardiovascular risk factors which cause cerebral hypoperfusion lead to disturbed hemodynamic flow, which ultimately results in ischemic disruption of microstructural integrity of neurons causing vascular dementia [8]. Studies have shown that cerebral autoregulation does not necessarily protect the brain from chronic brain hypoperfusion that is caused by low cardiac output or hypotension. It is especially worrisome in older people because the mechanism of cerebral autoregulation may become impaired with old age [1].

If there is no reversible cause found on investigating the patient for bradycardia, as was the case in our patient, permanent pacemaker implantation is the ultimate answer for patients with symptomatic bradycardia [5]. Indications for permanent pacemaker implantation come under the umbrella of four classes: (I) mandatory, (IIa) reasonable, (IIb) possible, and (III) contraindicated [2]. In our case, there was class I indication: sinus node dysfunction with documented symptomatic bradycardia, including frequent sinus pauses that produce symptoms. Implantation of permanent pacemaker is highly cost-effective, safe, and simple to carry out. It can be implanted in all age groups, but it is especially prevalent in older people because of the increase in cardiac conduction abnormalities in this age group [9]. Koide et al. [7] described in their study that cognitive impairment can be reversed by cardiac pacing. It is attributed to the fact that maintaining adequate heart rate can improve cerebral perfusion and hence cognitive functioning [1,6].

Because of the fragility of conditions in elderly people, basic knowledge of bradyarrhythmias and decision of pacemaker implantation are crucial elements for the treating physician [10].

Conclusion

Bradycardia is a common manifestation of cardiovascular diseases with different presentations. These cases should be thoroughly investigated for the cause and should be treated early and accordingly to prevent any further life-threatening complications.

Our patient was having sinus bradycardia complicated by sinus pauses and memory impairment: cardiogenic dementia was successfully treated with permanent pacemaker implantation.

What is new?

Patients with sinus bradycardia usually present with dizzy spells and shortness of breath. Our patient had a distinct clinical presentation of memory impairment which improved rapidly after pacemaker implantation.

List of Abbreviations

JVP jugular venous pressure
CT-scan computed tomography scan

Consent for publication

Written consent was obtained from the patient.

Ethical approval

Ethical approval is not required at our institution to publish an anonymous case report.

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Summary of the case

1	Patient (gender, age)	Male, 71-year old
2	Final diagnosis	Cardiogenic dementia improved after permanent pacemaker implantation
3	Symptoms	Memory impairment
4	Medications	Permanent pacemaker implantation
5	Clinical procedure	Pacemaker implantation
6	Specialty	Cardiology