High-Grade Atrioventricular Block and Takotsubo Cardiomyopathy: Case Report and Review of the Literature

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1. Introduction

Tako-Tsubo Cardiomyopathy (TCM) or apical ballooning syndrome or stress cardiomyopathy represents a distinct form of cardiac dysfunction that mimics Acute Coronary Syndromes (ACS), often associated with physical or emotional stress (1-3). An increasing number of case reports have indicated a potential association between high-grade atrioventricular (AV) block and TCM (4-15). Additionally, in some other cases, TCM developed after implantation of a pacemaker, implying that possibly the perioperative stress was the provocative factor (16-22). In this report, we briefly describe a case of AV block-induced TCM and we provide a concise and critical overview of all the similar cases reported in the literature.

2. Case Presentation

A 71-year-old woman was transferred to the hospital due to a typical syncopal episode of unknown duration associated with facial trauma. Her past medical history was significant only for arterial hypertension under treatment with irbesartan and hydrochlorothiazide. The patient did not report any significant chest pain or discomfort before the event, but she noticed a progressively worsening exertional dyspnea and fatigue during the past few days. A 12-lead ECG on admission showed intermittent 2:1 AV block with a left bundle branch block (not previously known) (Figure 1). Besides, an echocardiogram performed at the bedside demonstrated akinesis of the apical segments of the Left Ventricle (LV) with an estimated ejection fraction of 40%. Moreover, serial measurement of cardiac enzymes showed evidence of myocardial necrosis (positive troponin 6 hours after admission, and further increase at 12 hours) and, consequently, the patient managed as having ACS. Specifically, the patient was transferred promptly to the cath lab. After placement of a temporary pacemaker via the right femoral vein, coronary angiogram showed no...
significant stenoses (Figures 2A, 2B). Interestingly, the left ventriculography revealed a typical pattern of TCM with an akinetic apex and hypercontractile base (Figures 3A, 3B). Bearing in mind that TCM in most instances is a reversible cardiomyopathy while the cause-effect relationship in cases with concomitant AV block is not very clear, we decided not to proceed directly to pacemaker implantation. Indeed, on the 6th day of hospitalization, normal 1:1 conduction was restored with no improvement in LV systolic function. On the 10th day, however, the patient suffered a dizzy spell and the telemetry recorded an episode of complete AV block with prolonged ventricular asystole (Figure 4). Thereafter, the patient reverted back to 2:1 AV block and, thus, a dual-chamber pacemaker was implanted. Six months after the implantation, the patient remains on 2:1 AV block while the LV systolic function has been completely normalized.

3. Discussion

TCM represents an increasingly recognized entity in the setting of ACS, sometimes associated with serious complications (1-3). However, in most cases, the prognosis is excellent with full recovery of myocardial function and low recurrence rates. In particular, stressful events may trigger the development of this specific cardiomyopathy. Its exact pathophysiology remains unknown although microvascular dysfunction, diffuse coronary spasm, autonomic disturbances, and neurogenic injury/stunning have been implicated (1-3). TCM may be provoked by a variety of stimuli and conditions that can induce a catecholamine surge (1-3). Patients with TCM present
with symptoms suggestive of ACS, transient and reversible changes of the ST-segment (mainly elevation) in the electrocardiogram, and a small increase in cardiac troponin levels (1-3). The characteristic imaging findings include the hypokinesis or akinesis of the apical segments of the LV along with hypercontraction of the basal segments as well as the absence of obstructive coronary lesions. Variants, such as midventricular TCM and reversed TCM, have also been described. Moreover, other secondary causes, such as pheochromocytoma, myocarditis and cerebrovascular accidents, should be excluded (2).

It should be noted that an association between TCM and advanced conduction abnormalities has been recently recognized (Table 1). Nonetheless, the cause-effect relationship is not clear yet. However, in most of the published cases, the AV conduction abnormality persisted for a long time despite the improvement of segmental wall motion abnormalities and LV systolic dysfunction (Table 1). Only in 2 cases, the AV block was transient and no permanent pacemaker was implanted (9, 15). In other words, it seems that in most instances, the conduction abnormality was the primary independent event that triggered TCM and not vice-versa. In a very recent observational study from the Tokyo CCU Network database, advanced AV block was observed in 2/107 cases at the time of hospitalization, requiring permanent pacemaker implantation in 1 patient (23). However, no further details regarding these 2 patients were available (not included in Table 1).

It would be reasonable to assume that excessive bradycardia and AV dissociation elicit an adrenergic response that drives the pathophysiological alterations of TCM. Moreover, patients with AV block-induced TCM seemed to have a favorable outcome without residual LV dysfunction (Table 1). Also, a female predominance was evident and most patients had advanced age (Table 1). In addition, a classical pattern of apical ballooning was noticed in all the cases, while the midventricular pattern was evident in 1 case (15) (Table 1). In general, temporary pacing and a few-day waiting period appear to be a reasonable strategy although, as mentioned before, most patients need permanent pacing. Interestingly, in several cases, a significant QT prolongation was evident, while associated episodes of Torsades de Pointes (TdP)
occurred in some instances (4, 6-8). Of note, temporary pacing at relatively high rates decreased the QT interval and prevented the recurrence of TdP (6, 8). It seems that besides AV block, other forms of excessive bradycardia can be associated with TCM. In specific, 2 cases of sinoatrial block accompanied by TCM have been published in the literature (4, 24). On the other hand, 9 published cases indicated the development of TCM after permanent pacemaker implantation (Table 2) (16-22). Although this particular operation represents a minor surgical procedure, it may cause significant stress. Thus, this stressful condition may

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<th>Table 1. The Reported Cases of Advanced Atrioventricular Block Associated with Takotsubo Cardiomyopathy</th>
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<tr>
<td>Authors (Year)</td>
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<tr>
<td>Saito M, et al. (2004)</td>
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<td>Lee WL, et al. (2006)</td>
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<td>Siry M, et al. (2011)</td>
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<td>Shanmugasundaram R, et al. (2012)</td>
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<td>Benouda L, et al. (2012)</td>
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<td>Chadha S, et al. (2013)</td>
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Abbreviations: AV, atrioventricular; LV, left ventricular; N/A, not available; PPM, permanent pacemaker; TCM, takotsubo cardiomyopathy
In conclusion, high-grade AV block may induce TCM in susceptible individuals, while the same is true in some patients undergoing pacemaker implantation due to the stressful operation. Clinicians should be aware of these associations and promptly implement appropriate diagnostic and therapeutic procedures in affected individuals.

Acknowledgements

There is no acknowledgement.

Authors’ Contribution

Panagiotis Korantzopoulos, Dimitrios Nikas, Ioannis Gkirdis, Marios Kolios, and Ioannis Ntalas: Evaluation and management of the patient, literature search, and drafting of the manuscript. Panagiotis Korantzopoulos, Dimitrios Nikas, Konstantinos Letsas, John and Goudevenos: Critical revision of the manuscript. Panagiotis Korantzopoulos, Dimitrios Nikas, Ioannis Ntalas: Evaluation and therapeutic procedures in affected individuals. Chuck, et al. (2007) First degree AV block evolved into Mobitz I block Syncope 12 hours later > 60% 20% Yes, LV ejection fraction 50%

Abu Sham'a, et al. (2009) 1 female, 86 year-old Complete AV block Syncope After 1 day 60% 20% Yes, complete

Kohnen RF and Baur LHB. (2009) 1 female, 83 year-old Sick sinus syndrome/ tachy-brady Complete AV block Dyspnea, peripheral edema Immediately after the implantation 55% 40% Yes, complete

Brunetti ND, et al. (2011) 1 female, 65 year-old Complete AV block Worsening dyspnea A few hours later (in the context of pneumothorax) 50% 25% Yes, complete

Golzio PG, et al. (2011) 1 female, 67 year-old Advanced AV block Angina in the past First postoperative day N/A N/A Yes, complete

1 female, 64 year-old Sick sinus syndrome Angina in the past First postoperative day N/A N/A Yes, complete

Table 2. Reported Cases of Takotsubo Cardiomyopathy Following Pacemaker Implantation

Authors (Year) Case(s), Gender, Age Indication for PPM Clinical Presentation Time of TCM Occurrence after PPM Implantation LV Ejection Fraction Before PPM Implantation LV Ejection Fraction When TCM Diagnosed Recovery of LV Systolic Function

Kurisu S, et al. (2006) 1 female, 89 year-old Complete AV block Dizziness The following day 62% 38% No
1 female, 77 year-old Complete AV block Exertional dyspnea 3 days later 75% 27% No
1 female, 54 year-old Complete AV block Syncope 3 hours later N/A N/A Yes, after 14 days

Kimura K, et al. (2007) 1 female, 77 year-old First degree AV block evolved into Mobitz I block Syncope 12 hours later > 60% 20% Yes, LV ejection fraction 50%

Chun, et al. (2007) 1 female, 77 year-old

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trigger TCM in some susceptible individuals. It is evident that in these cases, the LV systolic function was normal before the implantation and dramatically worsened in the context of postoperative TCM (Table 2). Remarkably, in 2 instances, no recovery of LV systolic function was observed during follow-up (22). Also, there seems to be a more severe myocardial insult since the observed LV ejection fraction during the acute phase of TCM was moderately to severely depressed in most of the cases (Table 2).

In conclusion, high-grade AV block may induce TCM in susceptible individuals, while the same is true in some patients undergoing pacemaker implantation due to the stressful operation. Clinicians should be aware of these associations and promptly implement appropriate diagnostic and therapeutic procedures in affected individuals.

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Financial disclosure

The authors declare that there is no conflict of interests regarding the publication of this paper.

Funding/SUPPORT

There is no funding/support.

References


Korantzopoulos P et al.


