Case Report

Rate dependent left bundle branch block during general anaesthesia: Lesson for a novice anaesthetist

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ABSTRACT

Rate-dependent left bundle branch block (LBBB) during general anaesthesia is rare. While it is usually a benign disorder, it may mask the electrocardiographic diagnosis of acute myocardial infarction and ST-T pattern associated with LBBB may mistaken for those of ischemia. To the best of our knowledge there are only few case reports of rate dependent LBBB during intraoperative period in the literature. Herein, we present a case of rate-dependent left bundle branch block developed intra-operatively in a 70 years old female patient with no previous history of ischaemic heart disease and structurally normal heart.

CASE REPORT

Rate dependent left bundle branch block (LBBB) occasionally occurs during anaesthesia when the heart rate exceeds a critical value. Transient LBBB has been associated with increased heart rate under general and local anesthesia and without obvious aetiologic factors during anaesthesia [1]. It is usually a benign disorder but it may mask the ECG manifestations of ischemia. This case report describes a case of rate dependent LBBB which occurred during general anaesthesia. Criteria for correct diagnosis of this benign entity of LBBB and methods for reversion to normal sinus rhythm for confirming the rate-dependent LBBB will be discussed in this article.

A 70 year-old, 45 kg, female patient diagnosed as a case of basal cell carcinoma of forehead and was posted for surgery. On preanaesthetic evaluation she gave no history of angina on exertion, dyspnea on exertion, pre-syncpe and syncope. On systemic examination there was no significant abnormality in cardiovascular system and respiratory systems. Her routine blood investigations were within normal limit. Her Pre operative ECG showed normal LV function. The induction of general anaesthesia was done with intravenous propofol 90mg and fentanyl 90 microgram. Her blood pressure was 140/90 mmHg and her heart rate was 92 beats per minute prior to induction. Tracheal intubation was done with 7 mm internal diameter cuffed endotracheal tube and was accomplished with intravenous vecuronium 4.5mg. Anaesthesia was maintained with oxygen, nitrous oxide in 40:60 ratios and 0.5-1% isoflurane. One minute later there was T wave inversion that progressed to ST depression and widened QRS complex on the ECG monitor. ECG taken at that time showed heart rate of 160 beats per minute with LBBB (Fig 1B). The procedure was abandoned after 5 minutes of observation because persisting LBBB on ECG, although the patient was hemodynamically stable.

Immediately anaesthesia was discontinued and patient was shifted to cardiac intensive care unit with possible differential diagnosis of new onset myocardial infarction or ischemia, rate dependent left bundle branch block. In cardic ICU we evaluated the patient, there was no complaint of chest pain, vitals were stable and bed side echocardiography showed normal wall motion abnormality. In the absence of pre-existing complaints of ischemic heart disease, and observing the morphology of left bundle branch block (along with the ST-T changes) which was not following the criteria for acute myocardial infarction. So, the diagnosis of rate-dependent left bundle branch block was considered first and decided to attempt to decrease her heart rate and assess the response. Carotid sinus massage was performed for a total of 15 seconds but not successful in decreasing the heart rate after that iv metoprolol 5 mg was given, this resulted in her heart rate...
reverting to sinus rhythm with a heart rate of 78 bpm (Fig 1C), confirming the diagnosis of benign rate dependent LBBB in this case and patient remained well and asymptomatic throughout the period of hospitalization. Further cardiological investigations: cardiac troponins, CT coronary angiography and Holter monitoring showed no abnormalities.

**Discussion:**

The rate-dependent bundle branch block is defined as an intraventricular conduction defect that may return, if only temporarily, to sinus rhythm at lower heart rates[2]. Although rate dependent LBBB is usually a benign disorder, diagnosing and treating it are clinically important for several reasons. First, it may mask the electrocardiographic manifestation of myocardial infarction[3]. Second, the ST-T changes associated with LBBB may be mistaken for ST-T changes due to ischemia. Third rate related LBBB may also be mistaken for slow ventricular tachycardia and may be inappropriately treated.

The mechanism of transient bundle branch block is unclear but may be a result of anatomic or physiologic interruptions of a conducting bundle from ventricular enlargement and strain with dilation of the appropriate chamber, and from neurogenic or functional depression with or without underlying pathologic lesions of the conducting tissues[4]. Transient bundle branch block caused by increases in heart rate is referred to as rate-dependent left bundle branch block. It occurs whenever the heart rate exceeds a certain critical value[5]. Bauer has pointed out that this transition from normal to abnormal intraventricular conduction may be related to alterations of heart rate of only one or two beats per minute[4]. The onset of rate-dependent left bundle branch block is sudden in most patients and once initiated, it persists until the heart rate is slower than that which triggered it. This critical rate is also dependent on the rate of change in heart rate[6]. With rapid decrease in heart rate, sinus rhythm may appear at higher rates and with rapid acceleration in heart rate, it may appear at lower heart rate, as the heart rate increase RR interval shortens and the descending impulses finds one of the bundle branches still in its refractory period[2].

There are some pitfalls in the diagnosis of rate-dependent left bundle branch block apart from its rare occurrence. Transient left bundle branch block may occur during an acute myocardial infarction, but diagnosing myocardial infarction in the presence of left bundle branch block is often difficult[7]. This is because altered patterns of ventricular conduction encountered in patients with left bundle branch block may conceal the ECG abnormalities associated with myocardial infarction. An anaesthetized patient unable to complain of chest pain following ischaemia and rate-dependent left bundle branch block may be associated with atypical chest pain, possibly related to the paradoxical cardiac movement occurring at onset of left bundle branch block, and not due to myocardial ischaemia[8]. Further confounds the diagnosis of myocardial infarction in these settings.

The Sgarbossa criteria for the diagnosis of acute myocardial infarction in the presence of left bundle branch block[9] are (1) ST segment elevation 1 mm discordant with the QRS complex (score of 5); (2) ST segment depression 1 mm in leads V1, V2 or V3 (score of 3) and (3) ST segment elevation 5 mm discordant with the QRS complex (score of 2). A total score of three or more suggests that the patient is experiencing an acute infarction. In our patient, the ECG changes of LBBB did not the diagnostic criteria of Sgarbossa and reverted back to normal sinus rhythm while heart rate is decreased, confirmed the diagnosis of rate-dependent left bundle branch block, and ruled out acute myocardial infarction (AMI).

The ability of the anaesthetist to correctly and quickly interpret the ECG and a clear understanding of the differences between rate-dependent LBBB and LBBB associated with myocardial ischaemia or infarction in such complicated patients is important because it may directly influences patient management by avoiding unnecessary investigations or ICU admissions. It is thus important to be aware of the ECG changes that may indicate acute myocardial infarction when the ECG is complicated by the presence of left bundle branch block (Sgarbossa criteria), because the outcome of patients with left bundle branch block with acute myocardial infarction is significantly improved by acute reperfusion therapies.

By observing the morphology of left bundle branch block, a clinically applicable and convenient method to diagnose the rate dependence is to decrease the heart rate by various means and observe the effect on the ECG. Various physiologic manipulations such as carotid massage and deep inspiration, and pharmacological agents like esmolol, metoprolol, propranolol, neostigmine and edrophonium result in slowing the heart rate and thus changing aberrant conduction back to normal[10]. However, most of the interventions aimed at altering the heart rate to diagnose rate-dependent left bundle branch block have associated adverse effects, e.g. beta blockers and edrophonium may cause AV block in patients with AV nodal disease. Carotid sinus massage is a simple physiologic manipulation that may be successful in reducing heart rate but it is not advisable in patients with carotid artery disease or cerebro-vascular disease.

This case report demonstrates the use of selected pharmacologic agent (metoprolol) to alter the heart rate and confirm the diagnosis of benign rate dependent left bundle branch block in the perioperative period.

In conclusion, rate-dependent left bundle branch block occurring under general anaesthesia is a rare event. Rate-dependent LBBB offers a diagnostic challenge to the anaesthetist and knowledge of the pitfalls associated in its diagnosis is necessary for correct management of the patient and unnecessary postponement of surgery.
Figure 1: Pre operative electrocardiogram showing normal sinus rhythm.

Figure 2: Intra operative electrocardiogram shows left bundle branch block with heart rate of 150bpm

Figure 3: Post operative electrocardiogram shows normal sinus rhythm after reversion by iv metoprolol.

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