# Apparent amelioration of bundle branch blocks and intraventricular conduction delays mediated by anasarca

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**Abstract**        Nine patients aged 76.2 ± 8.0 years, 3 males and 6 females, who had suffered anasarca due to various illnesses, and had bundle branch block (BBB) or intraventricular conduction delays (IVCD) on admission (3 with complete left BBB [LBBB], 2 with incomplete LBBB, 2 with complete right BBB, and 2 with complete IVCD), are described. After gaining 48.2 ± 26.9 lb because of anasarca, their electrocardiograms revealed decreased QRS duration (112.7 ± 18.9 milliseconds), as compared with the same measurement on admission (130.1 ± 12.6 milliseconds) ($P$ = .015), with 4 patients showing apparent conversion of their complete BBB or IVCD to incomplete BBB, or normal IVC. Of these 9 patients, 5 lost subsequently 45.6 ± 37.0 lb, and this was now associated with an increase in the QRS duration from 109.6 ± 23.0 to 127.8 ± 17.4 milliseconds ($P$ = .004), with 1 patient converting from normal IVC to incomplete LBBB, and 1 from incomplete to complete IVCD. These findings suggest that anasarca leads to apparent amelioration of the features of BBB or IVCD, with subsequent return to the baseline complete BBB or IVCD after loss of fluid overload; consequently, accurate characterization of a patient's BBB or IVCD is interfered with by the presence of anasarca. The pathophysiologic mechanism of this phenomenon has been traced to decreases of voltage across the entire electrocardiographic curve due to attenuation of the electrical impedance of the body volume conductor due to accumulation of the anasarca fluid.
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## 1. Introduction

The diagnosis of intraventricular conduction (IVC) abnormalities includes both a morphologic description as well as a reference to the corresponding IVC duration in milliseconds [1-8]. Accordingly, the electrocardiographic (ECG) diagnosis of left bundle branch block (LBBB), right bundle branch block (RBBB), and intraventricular conduction delay (IVCD) is appreciated as mutually exclusive, with the last not conforming in appearance to either LBBB or RBBB [1-8]. Duration of IVC <100 milliseconds is

considered normal, ≥100 milliseconds to <120 milliseconds is indicative of an incomplete RBBB, LBBB, or IVCD, and ≥120 milliseconds confirms the presence of a complete RBBB, LBBB, or IVCD.

Anasarca peripheral edema, irrespective of the underlying pathophysiology, attenuates markedly the amplitude of QRS complexes [9]. Furthermore, anasarca shortens the QRS complexes of IVC in milliseconds [10], as measured by automated interpretation ECG programs [11]. Although the abbreviated in duration QRS complexes during anasarca are clearly apparent to the naked eye, or with the aid of a magnified glass when compared to the QRS width from ECG tracings before the body fluid accumulation, an accurate specific number assignment (in milliseconds) is realistically unattainable and requires the aid of an automated measurement provided by an ECG interpretation

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software program [11]. The opportunity arose to observe 9 patients with a BBB or IVCD before and after the development of anasarca, and its effect on the IVC disturbances, and led to the present communication.

## 2. Patients

Nine patients aged 76.2 ± 8.0 years (range, 61-85 years), 3 males and 6 females, from a total of 28 [9], who were admitted with a critical noncoronary illness (gastro-intestinal bleeding [2], pneumonia [7], sepsis [7], cirrhosis [1], congestive heart failure [2], respiratory arrest [1], and anoxic encephalopathy [1]) and suffered anasarca in the process of their hospitalization had a BBB or IVCD on admission (Figs. 1 and 2). Three had complete LBBB, 2 had incomplete LBBB, 2 had complete RBBB, and 2 had complete IVCD. At peak weight, these 9 patients had gained 48.2 ± 26.9 lb (range, 8.6-97.0 lb), and their ECGs revealed stability of the morphologic features of BBB, but with decreased QRS duration (112.7 ± 18.9; range, 74-137 milliseconds), as compared with the same measurement on admission (130.1 ± 12.6; range, 112-151 milliseconds) (P = .015). Measurements of the QRS complexes derived from the automated ECG interpretation program and

constituted part of the ECG automated printed report [11]. All ECGs were obtained with the same ECG machine, and the calibration for all tracings was the same (1.0 cm = 1.0 mV). In terms of changing BBB classification, of the 9 patients, 1 was changed from complete LBBB to incomplete LBBB (Fig. 1), 1 with incomplete LBBB developed normal IVC, 1 with complete RBBB showed incomplete RBBB (Fig. 2), and 1 with complete IVCD was changed to incomplete IVCD, whereas 5 did not change classification. These changes were not transient, for example, lasting only for 1 or 2 days, but persisted for many days, while the patients were edematous, as it could be ascertained by serial daily ECGs. In addition, the specific BBB pattern or IVCD on admission before the emergence of anasarca was stable for a number of days in these patients, and change occurred pari passu with the fluid accumulation.

Of these 9 patients, 5 lost subsequently some weight after gaining their peak weight (45.6 ± 37.0, range, 3.7-94.3 lb). This was associated with an increase in the QRS duration from 109.6 ± 23.0 to 127.8 ± 17.4 milliseconds (P = .004). In terms of changing IVC classification, of these 5 patients, 3 remained stable in their specific classification, whereas 1 changed from normal IVC to incomplete LBBB, and the other from incomplete to complete IVCD (Fig. 3).
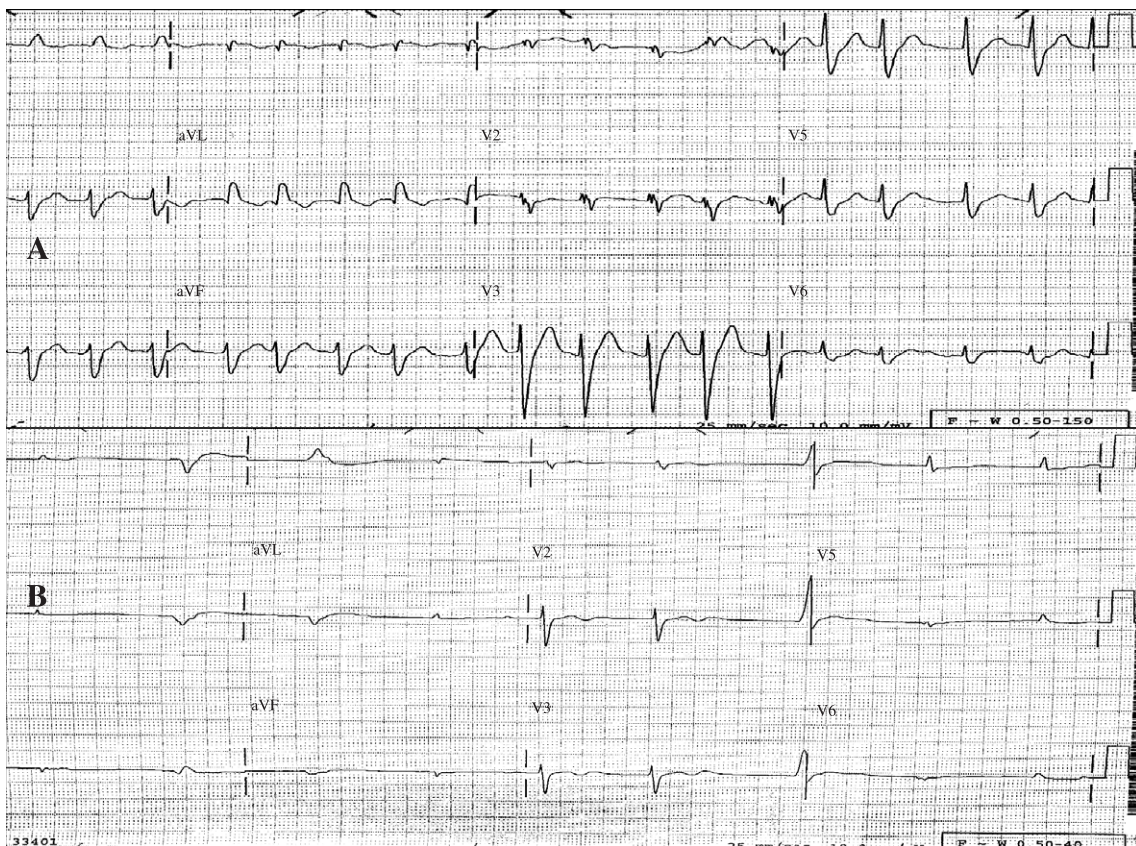


Fig. 1. A 79-year-old woman with complete LBBB before (A, January 12, 1999) and after (B, January 27, 1999) gaining 59.5 lb showed reduction of QRS duration from 151 to 106 milliseconds and apparent conversion to incomplete LBBB.