Brugada-like electrocardiographic pattern induced by an episode of anemia

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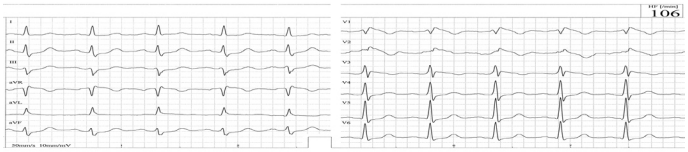
Introduction:
In 1992 Brugada and Brugada reported about patients without structural heart disease, with ST-segment elevations in leads V1 to V3 and a right bundle branch block pattern who developed ventricular fibrillation or sudden cardiac death, recognised as the Brugada syndrome (5). It is believed to be responsible for at least 4 % of all sudden deaths (2). A mutation in the cardiac Na+ channel gene SCN5A has been found as the substrate of the syndrome. Administration of Na+ channel blockers augments the ST-segment elevations in lead V1 to V3. The ST-segment elevation and its morphology undulates (2, 13, 14). Little is known about the mechanisms for this undulation of ST-segment elevation.

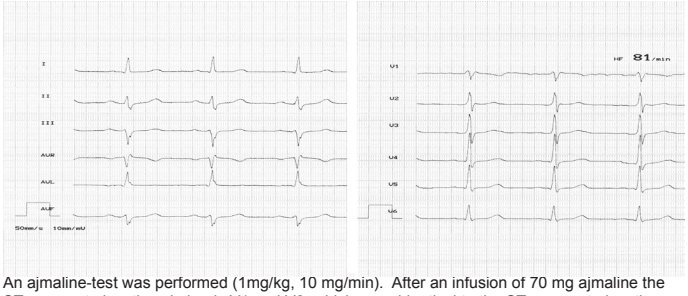
Case report:
A 39-year-old man with gastrointestinal bleeding was admitted to our institution. On admission his hemoglobin level was 6.3 g/dl due to a helicobacter pylori positive duodenal ulcer. After eradication treatment and blood transfusion the control scope documented an ulcer in healing with a fibrous cap. The hemoglobin level was 10.2 g/dl.

Figure 1



The ECG on admission documented a sinus tachycardia with 106 bpm, left axis with an incomplete right bundle branch block and ST-segment elevations of more than 4 mm in leads V1 and V2 in a coved-type pattern suspicious for Brugada-syndrome (FIGURE 1). The Control-ECG at a hemoglobin of 10.2 g/dl showed no significant ST-segment elevations (FIGURE 2).

Figure 2



An ajmaline-test was performed (1mg/kg, 10 mg/min). After an infusion of 70 mg ajmaline the ST-segment elevations in leads V1 and V2, which were identical to the ST-segment elevations on admission, could be induced (FIGURE 3 and 4).
The patient had no history of syncope, dizziness, arrhythmias or sudden death within his family. Because the patient was on a vacation and not from the area of our institution no ECGs of his family members could be obtained.
The echocardiogram, Holter-ECG, treadmill stress test and the MRT-scan of his heart were normal. Because of a history of chest pain a coronary angiogram was performed which was normal.
During an electrophysiological study with controlled ventricular stimulation from the right ventricular apex and the right ventricular outflow tract, with application of one to three extrastimuli at cycle lengths of 500, 400 and 330 msec and with an infusion of orciprenaline no arrhythmia could be induced. The AH-interval was 64 msec. The HV-interval was 56 msec.
Because of the absence of sudden cardiac death in his family and no induction of ventricular arrhythmias during the electrophysiological study, the asymptomatic patient was dismissed without an implantable defibrillator.

Figure 3

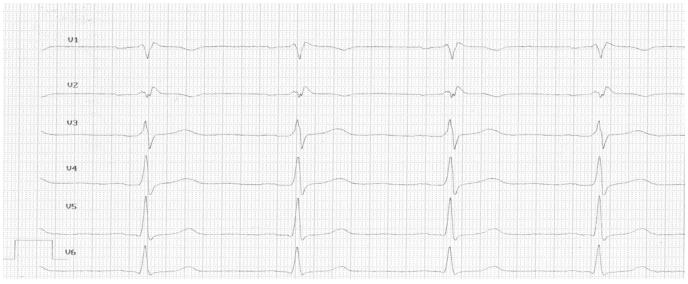
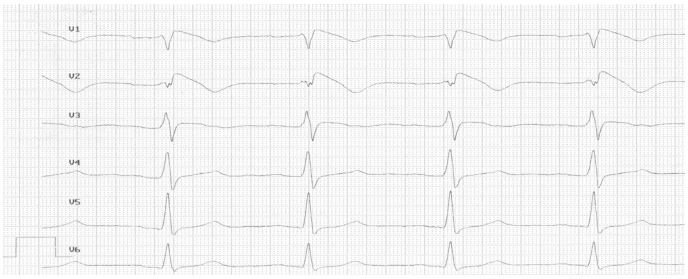


Figure 4



Discussion and Conclusion
There is conflicting data about the prognosis of individuals who are asymptomatic and present brugada-like electrocardiographic pattern. Brugada et al. reported arrrhythmic events in 8% of asymptomatic individuals (4). These results were not observed by other investigators. Priori et al. (11) as well as Eckardt et al. (7) saw a risc of arrhythmic events of < 1% in populations of asymptomatic individuals with the brugada-like elctrocardiographic pattern and concluded a low risc of sudden cardiac death. Sakabe et al. reported about a risc of 0,25%/year of fatal arrhythmias in a group of asmyptomatic subjects with the brugada-like elctrocardiographic pattern and no family history of sudden death during a 10 year follow-up (12). There are also deviant opinions about the risc stratification of asymptomatic patients. Eckardt et al. found limited accuracy of programmed electrical stimulation in predicting arrhythmic events (7). Whereas Brugada et al. (4) suggested that the induction of ventricular arrhythmias during an electrophysiological study might predict the risc of sudden cardiac death.
Antzelevich et al. recommended in the report of the second concensus conference of the brugada syndrome (2) to perform an electrophysiological study in asymptomatic individuals displaying the brugada-like electrocardiographic pattern of the coved type if a familiy history of sudden cardiac death is suspected to be the result of the brugada syndrome and justified an electrophysiological study in asymptomatic individuals with a negative family history of sudden cardiac death if the coved-type ECG occurs spontaneously.

As well as the prognosis of individuals who are asymptomatic and present brugada-like electrocardiographic pattern, the mechanisms for the undulating pattern of ST-segment elevations in patients with the Brugada syndrome are still a matter of discussion.
Alings and Wilde suggested that an imbalance of inward and outward currents in the right ventricular epicardium, due to a reduced myocardial sodium current, creates a transmural voltage gradient and a dispersion of repolarisation (1). Dumaine et al. reported about temperature-dependent ionic mechanisms in the Brugada syndrome (6). Next to changes in body temperature or body movements, autonomic influence, as well as high insulin levels are held responsible for the ST-segment undulation (9, 10). Krittayaphong et al. reported about patients with the Brugada syndrome who had a low heart rate variability at night which might predispose the occurrence of VF episodes (8). In a case report Breuer et al. described a patient with the Brugada syndrome in whom the typical ST-segment elevations were first detected during an acute gastro-intestinal infection (3).
In our patient the ST-segment elevations were augmented during an episode of anemia and a concomitant sinus tachycardia. The ECG taken at a stabilized hemoglobin level, revealed no further ST-segment elevations.
During a treadmill test and an electrophysiological study with the application of orciprenaline a sinus tachycardia was induced without any ST-segment elevations.
It remains unclear if the anemia itself could be a trigger for the ST-segment elevation.
Another explanation for the changes in the ST-segment could be an impairment of the tone of the autonomic nerve system; adrenergic stimulation due to hypovolemia triggering a sinus tachycardia on the one hand and gastric pain with a succeeding increase in vagal tone on the other hand.

References
1. Alings M, Wilde A (1999) "Brugada" syndrome: Clinical data and suggested pathophysiological mechanism. Circulation 99:666-673
2. Antzelevich C, Brugada P, Borggrefe M, Brugada J, Brugada R, Corrada D, Gussak I, Lemarec H, Nademanee K, Riera ARP, Shimizu W, Schulze-Bahr E, Tan H, Wilde A (2005) Brugada Syndrome: Report of the second consensus conference: endorsed by the heart rhythm society and the European heart rhythm association. Cirulation 111: 659-670
3. Breuer HWM, Breithard G, Borggrefe M (1999) Das Brugada-Syndrom. Eine (un)typische Kasuistik. Z Kardiol 88: 467-472
4. Brugada J, Brugada R, Antzelevich C Towbin C, Nedemanee K, Brugada P (2002) Long term follow-up of individuals with the electrocardiographic pattern of right bundle branch block an ST-segment elevation in precordial leads V1 to V3. Circulation 105:73-78
5. Brugada P, Brugada J (1992) Right bundle branch block, persistent ST-segment elevation and sudden cardiac death: A distinct clinical and electrocardiographic syndrome: A multicenter report. J Am Coll Cardiol 20:1391-1396
6. Dumaine R, Towbin JA, Brugada P, Vatta M, Nesterenko VV, Nesterenko DV, Brugada R, Antzelevich C (1999) Ionic mechanism responsible for the electrocardiographic phenotype of the Brugada syndrome are temperature dependent. Circ Res 85:803-809
7. Eckardt L, Probst V, Smits JPP, Schulze Bahr E, Wolpert C, Schimpf R, Wichter T, Boisseau P, Heinecke A, Breithardt G, Borggrefe M, LeMarec H, Böcker D, Wilde AAM, (2005) Long-term Prognosis of Individuals with right precordial ST-segment-elevation Brugada Syndrome. Circulation 111:257-263
8. Krittayaphong R, Veerakul G, Nademanee K, Kangkagate C (2003) Heart rate variability in patients with Brugada syndrome in Thailand. European Heart Journal 24:1771-1778
9. Miyazaki T, Mitamura H, Miyoshi S, Soejima K, Aizawa Y Ogawa S (1996) Autonomic and antiarrhythmic drug modulation of ST-segment elevation in patients with Brugada syndrome. J Am Coll Cardiol 27:1061-107
10. Nishizaki M, Sakurada H, Ashikaga T, Yamawake N, Fujii H, Arita M, Isobe M, Hiraoka M (2003) Effect of glucose-induced insulin secreteion on ST segment elevation in the Brugada syndrome. J Cardiovasc Electrophysiol 14:243-249
11. Priori SG, Napolitano C, Gasparini M, Pappone C, Della Bella P, Giordano U, Bloise R, Guistetto C, De Nardis R, Grillo M, Ronchetti E, Faggiano G, Naftoli J (2002) Natural history of Brugada syndrome. Insight for risc stratification and management. Circulation 105: 1342-1347
12. Sakabe M, Fujiki A, Tani M, Nishida K, Mizumaki K, Inoue H (2003) Proportion and prognosis of healthy people with coved or saddle-back type ST segment elevation in the right precordial leads during 10 years follow-up. European Heart Journal 24:1488-1493
13. Sreeram N, Simmers T, Brockmeier K. (2004) The brugada syndrome. Its relevance to paediatric practice. Z. Kardiol 93:784-790
14. Wilde A.A.M, Antzelevitch C, Borggrefe M, Brugada J, Brugada R, Brugada P, Corrado D, Hauer R.N.W, Kass R.S, Nademanee K, Priori S.G, Towbin J.A (2002) Proposed diagnostic criteria for the Brugada syndrome consensus report. Circulation 106:2514-2519