

Prevalence of electrocardiographic abnormalities in patients with ischemic stroke, intracerebral hemorrhage, and subarachnoid hemorrhage

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Abstract

Introduction: This study investigated the prevalence of electrocardiographic (ECG) abnormalities in patients with ischemic stroke (IS), subarachnoid hemorrhage (SAH), and intracerebral hemorrhage (ICH) without chest pain or evidence of recent myocardial infarction (MI).

Material and methods: The patients included 169, mean age 67 years, with IS, 100, mean age 61 years, with ICH and 101, mean age 51 years, with SAH. All diagnoses were confirmed by magnetic resonance imaging or brain computed tomography. Patients with chest pain or a diagnosis of acute MI were excluded from the study. Twelve-lead ECGs were taken at the time stroke was diagnosed. All ECGs were interpreted by a cardiologist experienced in interpreting ECGs.

Results: Deep T wave inversion in the precordial leads was present in 0% of IS patients, 5% of SAH patients, and 5% of ICH patients. ST-segment depression was present in 17% of IS patients, 17% of SAH patients, and 26% of ICH patients. Left ventricular hypertrophy was present in 14% of IS patients, 8% of SAH patients, and 22% of ICH patients. Old Q-wave MI was present in 23% of IS patients, 6% of SAH patients, and 20% of ICH patients.

Conclusions: Deep T wave inversion in the precordial leads was present in 0% of IS patients, 5% of SAH patients, and 5% of ICH patients.

Key words: electrocardiogram, ischemic stroke, subarachnoid hemorrhage, intracerebral hemorrhage.

Introduction

Ischemic T wave inversion has been reported to occur in 20 to 46% of patients with subarachnoid hemorrhage [1-3], in 33 to 38% of patients with intracerebral hemorrhage [1, 3], and in 24 to 31% of patients with ischemic stroke [1, 3]. These studies included 28 patients [1], 61 patients [2], and 10 patients [3] with ischemic stroke, 16 patients [1] and 12 patients [3] with intracerebral hemorrhage, and 49 patients [1] and 72 patients [3] with ischemic stroke.

We have not clinically seen such a high prevalence of ischemic T wave inversion in patients with stroke who did not have chest pain and in whom an acute myocardial infarction was ruled out. Therefore, we performed the following study to determine the prevalence of electrocardiographic (ECG) abnormalities in a larger number of patients with ischemic stroke, subarachnoid hemorrhage, and intracerebral hemorrhage hospitalized for

acute stroke diagnosed by a neurologist and confirmed by magnetic resonance imaging or brain computed tomography who did not have chest pain or an acute myocardial infarction.

Material and methods

The patients were hospitalized at Westchester Medical Center/New York Medical College and included 94 men and 75 women, mean age 67±17 years, with ischemic stroke, 56 men and 44 women, mean age 61±15 years, with intracerebral hemorrhage, and 36 men and 65 women, mean age 51±15 years, with subarachnoid hemorrhage. All diagnoses were made by a board certified neurologist and confirmed by magnetic resonance imaging or brain computed tomography. Patients with chest pain or a diagnosis

of acute myocardial infarction were excluded from the study.

Twelve-lead ECGs were taken at the time stroke was diagnosed. All ECGs were interpreted by a cardiologist experienced in interpreting ECGs.

Results

Table I lists the prevalence of ECG abnormalities in the 169 patients with ischemic stroke, 101 patients with subarachnoid hemorrhage, and 100 patients with intracerebral hemorrhage. Table II compares the prevalence of ECG abnormalities in patients with ischemic stroke in 2 prior studies [1, 3] with the present study. Table III compares the prevalence of ECG abnormalities in patients with subarachnoid hemorrhage in 3 prior studies [1-3] with the present

Table I. Prevalence of electrocardiographic abnormalities in patients with ischemic stroke, subarachnoid hemorrhage, and intracerebral hemorrhage

Variable	Ischemic stroke (n=169)	Subarachnoid hemorrhage (n=101)	Intracerebral hemorrhage (n=100)
Deep T wave inversion in precordial leads	0 (0%)	5 (5%)	5 (5%)
ST-segment depression	28 (17%)	17 (17%)	26 (26%)
Left ventricular hypertrophy	23 (14%)	8 (8%)	22 (22%)
Old Q-wave myocardial infarction	38 (23%)	6 (6%)	20 (20%)
Supraventricular tachyarrhythmias	29 (17%)	2 (2%)	6 (6%)
Ventricular arrhythmias	10 (6%)	5 (5%)	5 (5%)
Left bundle branch block	9 (5%)	1 (1%)	5 (5%)
Right bundle branch block	8 (5%)	5 (5%)	4 (4%)
Sinus tachycardia	11 (7%)	16 (16%)	8 (8%)
Left anterior fascicular block	7 (4%)	4 (4%)	4 (4%)
Right ventricular hypertrophy	1 (1%)	0 (0%)	0 (0%)
First-degree atrioventricular block	6 (4%)	3 (3%)	4 (4%)
Second-degree sinoatrial block type 2	0 (0%)	0 (0%)	1 (1%)
Left atrial abnormality	10 (6%)	4 (4%)	8 (8%)
Normal electrocardiogram	40 (24%)	44 (44%)	14 (14%)

Table II. Comparison of prevalence of electrocardiographic abnormalities in patients with ischemic stroke in 2 prior studies with the present study

Variable	Goldstein [1] (n=49)	Dimant and Grob [3] (n=72)	Present study (n=169)
Deep T wave inversion in precordial leads	12 (24%)	22 (31%)	0 (0%)
ST-segment depression	12 (24%)	14 (19%)	28 (17%)
Left ventricular hypertrophy	12 (24%)	17 (24%)	23 (14%)
Old Q-wave myocardial infarction	11 (22%)	10 (14%)	38 (23%)
Supraventricular tachyarrhythmias	0 (0%)	10 (14%)	29 (17%)
Ventricular arrhythmias	8 (16%)	10 (14%)	10 (6%)
Left and right bundle branch block	5 (10%)	0 (0%)	17 (10%)

Table III. Comparison of prevalence of electrocardiographic abnormalities in patients with subarachnoid hemorrhage in 3 prior studies with the present study

Variable	Goldstein [1] (n=28)	Brouwers [2] (n=61)	Dimant and Grob [3] (n=10)	Present study (n=101)
Deep T wave inversion in precordial leads	7 (25%)	28 (46%)	2 (20%)	5 (5%)
ST-segment depression	8 (29%)	31 (51%)	4 (40%)	17 (17%)
Left ventricular hypertrophy	7 (25%)	22 (36%)	3 (30%)	8 (8%)
Old Q-wave myocardial infarction	6 (21%)	0 (0%)	1 (10%)	6 (6%)
Supraventricular tachyarrhythmias	3 (11%)	4 (7%)	0 (0%)	2 (2%)
Ventricular arrhythmias	2 (7%)	9 (15%)	0 (0%)	5 (5%)
Left and right bundle branch block	3 (11%)	7 (11%)	0 (0%)	6 (6%)

Table IV. Comparison of prevalence of electrocardiographic abnormalities in patients with intracerebral hemorrhage in 2 prior studies with the present study

Variable	Goldstein [1] (n=16)	Dimant and Grob [3] (n=12)	Present study (n=100)
Deep T wave inversion in precordial leads	6 (38%)	4 (33%)	5 (5%)
ST-segment depression	4 (25%)	3 (25%)	26 (26%)
Left ventricular hypertrophy	7 (44%)	3 (25%)	22 (22%)
Old Q-wave myocardial infarction	1 (6%)	2 (17%)	20 (20%)
Supraventricular tachyarrhythmias	1 (6%)	5 (43%)	6 (6%)
Ventricular arrhythmias	1 (6%)	1 (8%)	5 (5%)
Left and right bundle branch block	1 (6%)	0 (0%)	9 (9%)

study. Table IV compares the prevalence of ECG abnormalities in patients with intracerebral hemorrhage in 2 prior studies [1, 3] with the present study.

Discussion

In patients with subarachnoid hemorrhage, the prevalence of ischemic T wave inversion was 25% of 28 patients [1], 46% of 61 patients [2], 20% of 10 patients [3], and 5% of 101 patients in the present study. In these patients, ST-segment depression was present in 29% of 28 patients [1], 51% of 61 patients [2], 40% of 10 patients [3], and 17% of 101 patients in the present study. Left ventricular hypertrophy (LVH) was present in 25% of 28 patients [1], 36% of 61 patients [2], 30% of 10 patients [3], and 8% of 101 patients in the present study. Old Q-wave myocardial infarction was present in 21% of 28 patients [1], 0% of 61 patients [2], 10% of 10 patients [3], and 6% of 101 patients in the present study. Supraventricular tachyarrhythmias were present in 11% of 28 patients [1], 7% of 61 patients [2], 0% of 10 patients [3], and 2% of 101 patients in the present study. Ventricular arrhythmias were present in 7% of 28 patients [1], 15% of 61 patients [2], 0% of 10 patients [3], and 5% of 101 patients in the present study. Right or left bundle branch block was present in 11% of 28 patients [1], 11% of 61 patients [2], 0% of

10 patients [3], and 6% of 101 patients in the present study.

In patients with intracranial hemorrhage, the prevalence of ischemic T wave inversion was 38% of 16 patients [1], 33% of 12 patients [3], and 5% of 100 patients in the present study. In these patients, ST-segment depression was present in 25% of 16 patients [1], 25% of 12 patients [3], and 26% of 100 patients in the present study. LVH was present in 44% of 16 patients [1], 25% of 12 patients [3], and 22% of 100 patients in the present study. Old Q-wave myocardial infarction was present in 6% of 16 patients [1], 17% of 12 patients [3], and 20% of 100 patients in the present study. Supraventricular tachyarrhythmias were present in 6% of 16 patients [1], 43% of 12 patients [3], and 6% of 100 patients in the present study. Ventricular arrhythmias were present in 6% of 16 patients [1], 8% of 12 patients [3], and 5% of 100 patients in the present study. Right or left bundle branch block was present in 6% of 16 patients [1], 0% of 12 patients [3], and 9% of 100 patients in the present study.

In patients with ischemic stroke, the prevalence of ischemic T wave inversion was 24% of 49 patients [1], 31% of 72 patients [3], and 0% of 169 patients in the present study. In these patients, ST-segment depression was present in 24% of 49 patients [1], 19%

of 72 patients [3], and 17% of 169 patients in the present study. LVH was present in 24% of 49 patients [1], 24% of 72 patients [3], and 14% of 169 patients in the present study. Old Q-wave myocardial infarction was present in 22% of 49 patients [1], 14% of 72 patients [3], and 23% of 169 patients in the present study. Supraventricular tachyarrhythmias were present in 0% of 49 patients [1], 14% of 72 patients [3], and 17% of 169 patients in the present study. Ventricular arrhythmias were present in 16% of 49 patients [1], 14% of 72 patients [3], and 6% of 169 patients in the present study. Right or left bundle branch block was present in 10% of 49 patients [1], 0% of 72 patients [3], and 10% of 169 patients in the present study.

To the best of our knowledge, the present study is the largest study describing the prevalence of ECG abnormalities in patients with documented acute ischemic stroke, subarachnoid hemorrhage, and intracranial hemorrhage. All of these strokes were diagnosed by a board certified neurologist and confirmed by magnetic resonance imaging or brain computed tomography. Patients with chest pain or acute myocardial infarction were excluded from this study.

Table II compares the prevalence of ECG abnormalities in patients with ischemic stroke in 2 prior studies [1, 3] with the present study. Table III compares the prevalence of ECG abnormalities in patients with subarachnoid hemorrhage in 3 prior studies [1-3] with

the present study. Table IV compares the prevalence of ECG abnormalities in patients with intracerebral hemorrhage in 2 prior studies [1, 3] with the present study. The ECG abnormalities in our patients with ischemic stroke, subarachnoid hemorrhage, and intracerebral hemorrhage were observed at the time of acute stroke and may be different at a different time after stroke.

The prevalence of deep T wave inversion in the precordial leads in the present study was 5% of 101 patients with subarachnoid hemorrhage, 5% of 100 patients with intracerebral hemorrhage, and 0% of 169 patients with ischemic stroke. These percentages are much lower than those reported in other studies [1-3] and are consistent with our clinical experience if patients with acute myocardial infarction are excluded.

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