# The significance of resting u wave polarity in patients with atherosclerotic heart disease

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*The purpose of this study was to determine the value of u wave polarity in D3, aVF and left precordial leads in patients with atherosclerotic heart disease.*

*One hundred twelve cases were entered into the study. All patients had u waves in their electrocardiograms. Fortyeightof them had unstable angina pectoris (UAP) and 64 had prior myocaridal infarction (MI) (20 had inferior, 35 had anterior and 9 had nonQ MI). Each of these subgroups was divided into 2 groups with positive (group I) and negative (group II) u waves.*

*All patients in this study underwent routine left ventriculography and coronary angiography. We examined coronary arteries and calculated ejection fraction (EF).*

*We detected that group II of the patients with UAP or anterior MI had 3 vessel disease more frequently ($p<0.05$). Also in these patients, there was more than 90% diameter narrowing in LAD vessel more frequently ($p<0.001$ in UAPand$p<0.05$ in anterior MI). In patients with UAP, inferior MI or anterior MI we observed that the EF was lesser in group II than group I ($p<0.001$ in UAP, $p<0.05$ in inferior MI and $p<0.05$ in anterior MI).*

*In conclusion we suggest that negative u wave in patients with UAP or anterior MI, may indicate multivessel disease with severe LAD lesion. Also we think that negative u wave in patients with UAP, inferior MI or anterior MI shows decreased EF. [Turk J Med Res 1993; 11(2): 93-96]*

Key Words: Polarity of u wave, Negative u wave, Atherosclerotic heart disease

The resting u waves have been reported to be associated with the presence of significant heart disease such as ischaemic heart disease, hypertension, cardiomyopathy, aortic and mitral regurgitation (1-6). However, the genesis of u waves, either positive or negative, has not yet been elucidated and there may be many conditions responsible for different polarities of u waves (1,7).

Kanemoto et al. (1) have suggested that negative u waves in patients with prior anterior MI are useful indicators of massive anterior infarction involving the apex and lateral wall, and are associated with depressed left ventricular function with an EF of less than 50%.

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The significance of negative u wave has not been examined in patients with UAP, inferior MI and nonQ MI by comparing coronary angiographic findings and EF.

## PATIENTS AND METHODS

We examined 112 cases with atherosclerotic heart disease. All patients had u waves in their electrocardiograms.

Fortyeigth of them had UAP (26 patients with positive u wave.mean age 52±9.33; 22 patients with negative u wave, mean age 56.41±8.36).

Twenty patients had prior inferior MI (8 cases with positive u wave, mean age 51.5±5.63, 12 cases with negative u wave, mean age 52.75±7.34).

Thirtyfive patients had prior anterior MI (15 cases with positive u wave, mean age 53±7.85; 20 cases with negative u wave, mean age 53.9+8.09).

Nine patients had prior nonQ MI (3 patients with positive u wave, mean age 52.25+6.95; 6 patients with negative u wave, mean age 55.13±3.64).

A 12-lead ECG was recorded just before cardiac catheterization and all of them were independently analysed by the two authors.

We defined the patients with positive u waves as group I and with negative u waves as group II (Figure 1,2). Patients with right and left bundle branch blocks and Wolff-Parsinson-White syndrome were excluded.

All patients in this study underwent routine left ventriculography and coronary angiography in multiple projection by the percutaneous femoral (Judkins') technique. Three independent observers graded the severity of stenosis in the three major coronary arteries and their branches. Significant coronary lesion was defined as at least 70% diameter narrowing of a coronary artery.

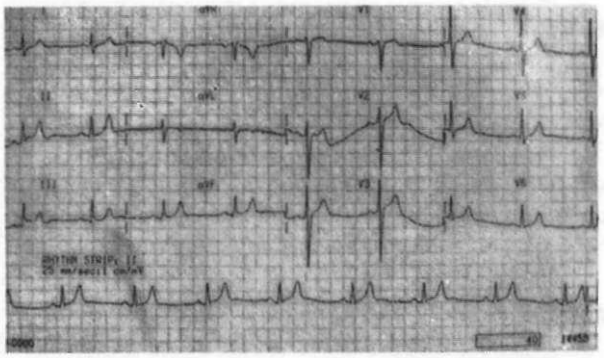

**Figure** 1. Twelwe lead electrocardiogram (ECG) from a patient in group I, demonstrating positive u waves in leads **V3-V8.**

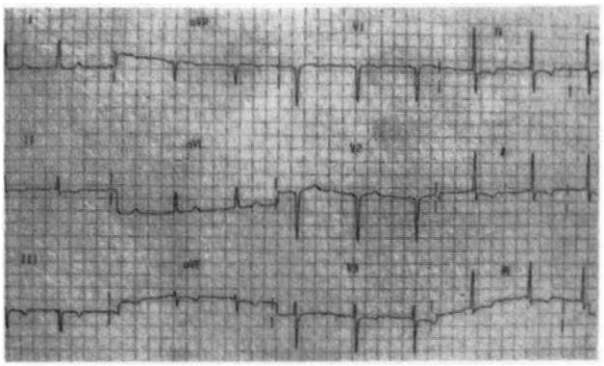

**Figure 2.** Twelwe lead electrocardiogram (ECG) from a patient in group II, demonstrating negative u waves in leads W V e.

Left ventirculography was performed at a 30° right anterior oblique projection during full inspiration. Leh ventricular EF was calculated for all patients using Simpson's rule method.

Control group included 16 patients who had undergone cardiac catheterization for atypical chest pain and had been found to have normal coronary arteries and left ventricular function (EF>60%). There were no u waves in their electrocardiograms.

## Data Analysis

All values are expressed as the mean±SD. Comparison of EF between groups I and II was made by student t-test and Mann-Whitney-u test. In both groups the degree of the coronary stenosis was examined by Khi square test and rigid analysis was carried out for the left main coronary vessel and LAD vessel involvement.

## RESULTS

The characteristics of patient populations are summarized in Tables 1 and 2. No significant differences existed in age and blood presure between the groups.

We detected 1-vessel disease in 73% of group I with UAP ($p<0.01$). However, group II patients with UAP had 3-vessel disease more frequently ($p<0.05$).

Likewise, in group II patients with anterior MI, we detected 3-vessel disease more frequently ($p<0.05$).

A significantly higher percentage of the patients with UAP or anterior MI and negative u wave had 90% stenosis in the LAD vessel ($p<0.001$) and $p<0.05$ respectively).

In patients with UAP, inferior MI or anterior MI we observed that the EF was lesser in group II than in group I ($p<0.001$ in UAP, $p<0.05$ in inferior MI and $p<0.05$ in anterior MI).

**Table!.**

| | | Age | Systolic BP | Diastolic BP |
|---|---|---|---|---|
| UAP | +u wave | 52±9.33 | 146.22±16.18 | 98.11 ±6.49 |
| | -u wave | 56.41 ±8.36 | 150.54±17.63 | 99.05±6.86 |
| Inferior MI | +u wave | 51.50±5.63 | 154.58± 16.44 | 97.92±7.53 |
| | -u wave | 52.75±7.34 | 152.50±12.15 | 97.92±7.53 |
| Anterior MI | +u wave | 53±7.85 | 154.52±15.64 | 98.67±5.49 |
| | -u wave | 53.9±8.09 | 152.66±19.81 | 100±5.48 |
| NonQ MI | +u wave | 52.25+6.95 | 147.50±9.57 | 97±5.70 |
| | -u wave | 55.13±3.64 | 150±13.09 | 95.63±5.63 |

mean±SD BP: blood pressure
UAP: unstable angina pectoris
MI: myocardial infarction

**Table 2.**

| | | 1 V | 2 V | 3 V | LM | LAD | EF |
|---|---|---|---|---|---|---|---|
| UAP n-48 | (+) u wave n-26 | 19 | 5 | 2 | 2 | 15 | 72.189±7.164 |
| | (-) u wave n-22 | 6 | 9 | 7 | 6 | 22 | 57.622±11.708 |
| | | p<0.01 | p>0.05 | p<0.05 | p>0.05 | p<0.001 | p<0.001 |
| Inferior MI n-20 | (+) u wave n-8 | 5 | 2 | 1 | – | – | 62.417±10.131 |
| | (-) u wave n-12 | 4 | 5 | 3 | – | 6 | 52.083±13.951 |
| | | p>0.05 | p>0.05 | p>0.05 | – | p<0.05 | p<0.05 |
| Anterior MI n-35 | (+) u wave n-15 | 6 | 7 | 2 | – | 9 | 51.53±7.04 |
| | (-) u wave n-20 | 5 | 6 | 9 | 2 | 19 | 44.1 ±13.47 |
| | | p>0.05 | p>0.05 | p<0.05 | p>0.05 | p<0.05 | p<0.05 |
| NonQ MI n-9 | (+) u wave n-3 | 3 | | – | – | 3 | 60±9.13 |
| | (-) u wave n-6 | 2 | 2 | 2 | 1 | 6 | 54±4.52 |
| | | | | | | | p>0.05 |

mean±SD EF : ejection fraction
LAD: left anterior descending coronary artery
LM : left main coronary vessel
MI : myocardial infarction
V vessel

The patient groups with nonQ MI were too small for comparing the severity of coronary artery disease. However in these patients, comparison of EF between group I and II was made by Mann-Whitney-u test and we did not observe any significant difference (p>0.05), (Table 2).

## DISCUSSION

The mechanism of the genesis of u wave is uncertain. The genesis may be different depending on the underlying heart disease and on whether the negative u wave is present at rest or induced by exercise (5,7-10).

The two main theories attribute the u wave either to mechanical events or to the repolarization of Purkinje fibers (4,9,10). The vector of the normal u wave approximately parallels that of the T wave, and a negative u wave in one of the three standard limb leads or six precordial leads is considered an abnormal finding (3). We observed negative u waves in D3 and aVF in patients with inferior MI and in left precordial leads in patients with anterior MI.

Furbetta et al. who attributed negative u waves to the delayed repolarization in diseased papillary muscles, found such waves in leads I, aVL and left precordial leads in patients with "left papillary muscle syndrome" and in leads III and aVF in those with "right papillary muscle syndrome" (11).

Negative u waves at rest have been observed in association with hypertension, left ventricular hypertrophy, myocardial ischaemia, aortic and mitral regurgitation, cardiomyopathy and aging. The incidence of negative u waves after MI in the literature is reported to be 30-65% (1,3,6,7,11,12).

In our study there weren't any significant differences in the mean age,systolic and diastolic pressure between group I and II. Our patients had only atherosclerotic heart disease. We observed negative u waves in 46% of patients with UAP, 60% of inferior MI, 57% of patients with anterior MI and 67% of patients with nonQ MI in this study.

Gerson and McHenry reported that the presence of u wave negativity on an anterolateral lead of the resting electrocardiogram in patients with chest pain and indications for coronary visualization corresponded to a significant stenosis of either the LAD or left main coronary artery In 89% of the cases and the prevalence of angiographic left ventricular dysfunction was 80% (2).

in this study we observed significant differences in the frequencies of multivessel disease between group I and II with UAP or anterior MI (p<0.05).

In patients with UAP or anterior MI who had negative u wave, there was more than 90% diameter narrowing in LAD vessel more frequently ($p<0.001$ and $p<0.05$ respectively).

Moreover, in group II with UAP, inferior MI or anterior MI, the EF was lesser than group I ($p<0.001$, $p<0.05$ and $p<0.05$ respectively).

In conclusion, we suggest that negative u wave in patients with UAP or anterior MI may indicate multivessel disease with severe LAD lesion. Furthermore, the patients with UAP, inferior MI or anterior MI who have negative u wave, seem to have decreased EF.

**Aterosklerotik kalp hastalarında istirahat EKG'sinde U dalgası polaritesinin önemi**

*Bu çalışmada, aterosklerotik kalp hastalarında D3, a VF ve sol prekordiyal derivasyonlarda u dalgası polaritesinin önemini araştırdık.*

*Çalışmamıza elektrokardiyografilerinde u dalgası bulunan 112 hasta alındı. Hastaların 48'inde unstabil angına pektoris (UAP) ve 64'ünde geçirilmiş miyokart infarktüsü (MI) (20'sinde inferior, 35'inde anterior ve 9'unda nonQ MI) vardı. Bu subgrupların herbiri, grup I (pozitif u dalgası olanlar) ve hepsine sol ventrikülografi ve koroner anjiografi yapıldı. Sol ventrikül ejeksiyon fraksiyonu (EF) hesaplandı.*

*UAP veya anterior MI'lü hastalarda grup //'c**e** 3 damar hastalığının daha sık olduğu gözlendi ($p<0.05$). Aynı zamanda bu hastalarda LAD arterde %90'ın üzerinde darlık görülme oranı da daha çoktu (UAP'de $p<0.001$, anterior MI'de $p<0.05$). UAP'li, inferior veya anterior MI'lü hastalarda grup //'c**e** EF'nun grup I'den daha az olduğu saptandı (UAP'dep<0.001, inferior MI'de $p<0.05$ ve anterior MI'de $p<0.05$).*

*Sonuç olarak; UAP'li veya anterior MI'lü hastalarda negatif u dalgası, ciddi LAD lezyonu ile birlikte olan çok damar hastalığına işaret edilebilir. Aynı zamanda negatif u dalgası UAP'li, inferior veya anterior MI'lü hastalarda düşük EF'nu gösterebilir. [TurkJMedRes 1993; 11(2): 93-96]*

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