Transtelephonic ECG in Slovenia

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Abstract. Transtelephonic ECG has been introduced in Slovenia in 1996. It has been operating on a regular basis since September 1997. Users of the system are health institutions and patients with CV diseases. They use portable 12- channel ECG weighing less then 200 grams. Diagnostic center is located in medical ICU in Clinical Center Ljubljana. In the first 20 months of regular operation we have received 852 calls, 450 of them being diagnostic. The most common reasons for calling were: ischaemic chest pain, atypical chest pain, palpitations and dyspnoea. Most common diagnoses made on the basis of history and ECG were: AMI, angina pectoris, paroxysmal tachycardias and atypical chest pain. In 186 cases the cardiologist's advice sufficed, 171 patients were reffered to the ER, 142 immediately and 29 only if suggested therapy hadn't been successful. To 82 patients new medication or chenged dosage of previous medication was suggested. With the intent to evaluate accuracy of the diagnoses made on the basis of history and transtelephonic ECG evaluation we followed up the patients who were sent to ER in Ljubljana upon our cardiologists' advice. On the basis of preliminary results we can conclude that TTE is as diagnostic as the conventional ECG and its' use shortens time from onset of symptoms to initiation of treatment, it lowers disability and mortality due to CV diseases and improves cost benefit.

1. Introduction

Transtelephonic ECG (TTE) has been introduced in the USA in the late sixties. In Slovenia TTE began to operate on the regular basis in spring 1997. It is our first step into one of the youngest branches of medicine – telemedicine. Our TTE system is divided into two large groups called Telelink and Mobilink. Patients with cardiovascular (CV) diseases and different health institutions like emergency outpatient clinics, old age homes and health resorts use Telelink. Mobilink includes people at high risk for CV diseases. ECG is recorded by a portable device [2,3,4] weighing 180 g, measuring 120 x 60 x 25 mm. It is world's first all - 12 – channel ECG. There is also special type of ECG device, which operates on a principle of a Holter monitor; it can memorize 30 sec before and 30 sec after the event. To record an ECG three self-adhesive electrodes are needed. They are connected with a device, which is placed in three different positions on patient's chest. It takes about one minute to record an ECG. Upon joining the system a user is instructed how to record an ECG, he or she is assigned an ID number and a reference ECG is recorded and stored in the computer. In a period without symptoms every user has an opportunity to send test ECGs. With that we try to limit sending of low quality recordings. In a Diagnostic center, located in medical ICU of Clinical Center Ljubljana, a nurse answers a call and stores a recording in the computer. Cardiologist then takes history, evaluates ECG and immediately gives advice to the patient. Diagnostic center has 24 – hours coverage with nurses and cardiologists.

2. Methods

It is a retrospective study of twenty months experience with TTE in Slovenia.

3. Results

In the period between September 1, 1997 and April 30, 1999 we received 852 calls. Out of that 450 were diagnostic (sent because of different symptoms), 223 of low quality and 179 reference and test ECGs.
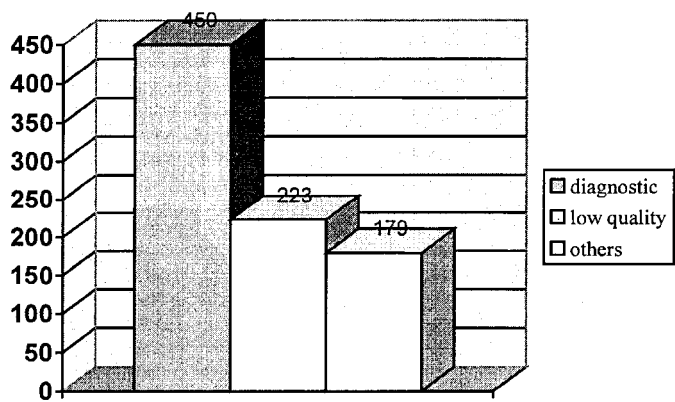

Figure 1. Call types: diagnostic – ECGs sent because of different symptoms; low quality – technical quality too low for evaluation; others – reference ECGs and tests

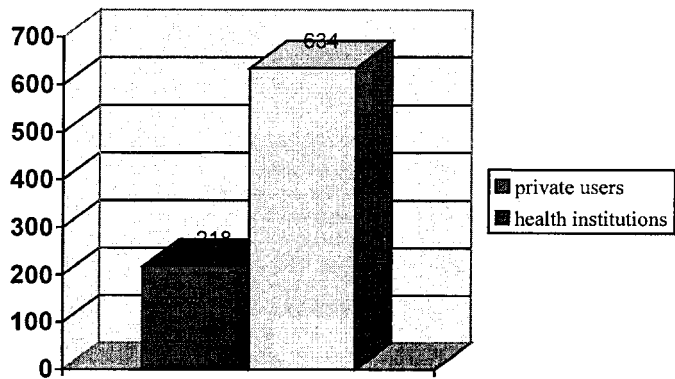Private users sent 218 and health institutions 634 recordings.

Figure 2. ECGs according to the sender: private users; health institutions.

Reasons for sending diagnostic ECGs were: ischaemic chest pain (32%), atypical chest pain (20%), palpitations (12%), dyspnoe (8%), syndrome GMAS and its equivalents (1%). 27% of ECGs were sent for other reasons.
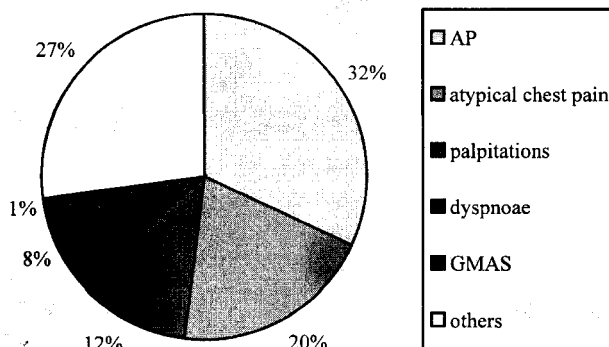

Figure 3: Reasons for sending ECGs: AP – angina pectoris, atypical chest pain – nonischaemic pain, palpitations, dyspnoea, GMAS – syndrome GMAS and its equivalents, others.

On the base of patient's history and ECG 25 acute myocardial infarctions, 131 anginas, 35 paroxysmal tachycardias, 4 GMAS syndromes and 2 pericarditides were diagnosed. 88 patients had unischaemic chest pain. The rest had less relevant diagnoses.
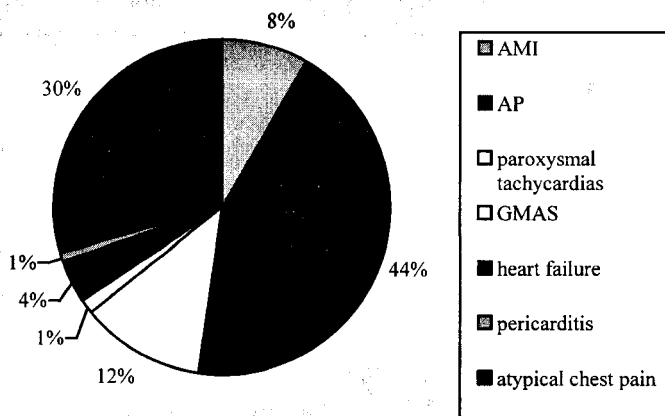

Figure 4: Most frequent diagnoses made on the basis of patient's history and ECG evaluation: AMI – acute myocardial infarction, AP – angina pectoris, paroxysmal tachycardias, GMAS – syndrome GMAS and its equivalents, heart failure, pericarditis, atypical chest pain.

In 184 cases only advice sufficed and changes in persisting medication or new medication was suggested to 82 patients. 171 patients were sent to ER, 142 immediately and 29 only if suggested therapy hadn't been successful. In two cases cardiologist guided general practitioner (GP) through CPR.
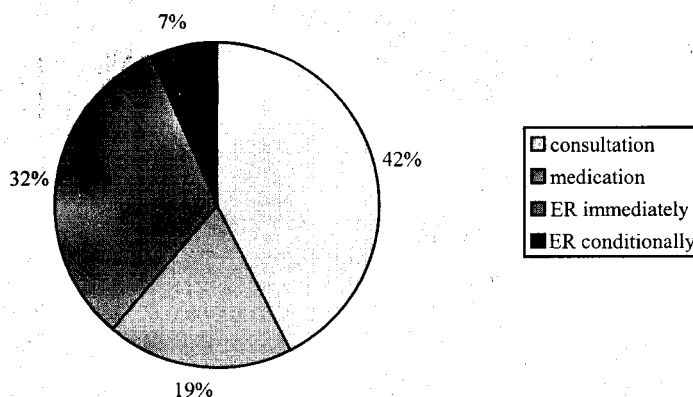

Figure 5. Doctors' measures: consultation – consultation only, medication – changed dosage of old medication or new medication advised, ER immediately – patient immediately referred to ER, ER conditionally – patient referred to ER only if suggested medication hadn't been successful, CPR – help in cardiopulmonary resuscitation.

To estimate the accuracy of the system we followed up the patients who were sent to ERs all over Slovenia. In twenty months there was 172 of these patients. We successfully followed up 66 patients. We compared diagnoses made in Diagnostic Center with those made in ERs. In 50 patients diagnoses were exactly the same and in 16 patients they were different. Severity of the illness was never underestimated.
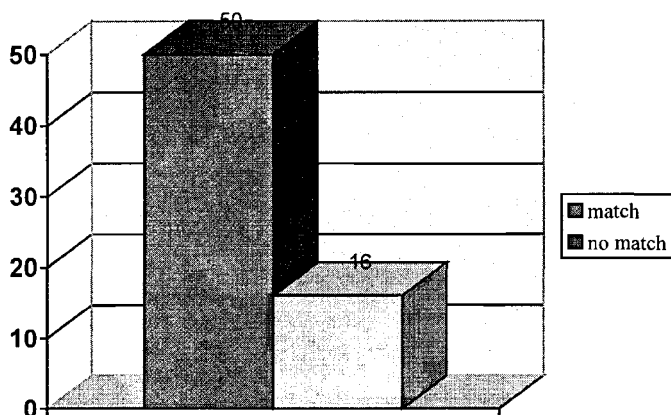
Figure 6. Diagnose matching

4. Discussion

Out of all 852 recordings 223 were of too low quality to be evaluated. The main reasons for that were low quality telephone lines on which we have no influence and unskilled senders. That indicates the need for better education of system users. We had no problems in receiving the ECGs. Personnel answering the calls are skilled enough and cardiologists were always available. In the beginning call reports were sometimes incomplete.

A significant majority of ECGs was sent from old age homes and emergency outpatients' clinics. In these cases TTE served as important help to GPs who are less skilled in ECG interpretation. GPs also had immediate opportunity to consult a specialist. Two most frequent reasons for sending diagnostic ECGs were chest pain and palpitations. These are also the most frequent reasons for patients to come to medical ERs in our country. In 6.5% of patients potentially life-threatening conditions (acute myocardial infarction, syndrome GMAS) were diagnosed. We can assume that these patients arrived to the ERs sooner, which shortened the time from onset of symptoms to treatment. They were also better monitored during the transportation than the others were. CV diseases are the main reason for mortality in Slovenia (7903 deaths in 1996, all deaths 18620). As the time to treatment is crucial for outcome we can conclude that an immediate consultation with a specialist and a quick correct diagnosis can lower mortality from CV diseases. In 3% of patients paroxysmal tachycardias were seen in ECGs most of them atrial fibrillations. With the use of TTE these patients more likely arrived to cardiologist within 48 hours, so the need for long-term anticoagulation was avoided. Almost two fifths of sent ECGs were normal. Most of these patients only got advice so they didn't need to visit the doctor. This certainly unburdens ERs.

5. Conclusions

Comparing to the rest of the world [1] our system has been operating for a relatively short period of time so our conclusions are made on small number of calls. In spite of that we think that TTE is as accurate as conventional one [4]. The most important achievement

is shortening of time from onset of symptoms to the adequate treatment. This is of most importance in urgent cases such as acute coronary syndrome and rhythm disturbances. In countries where TTE is more widespread it replaced frequent visits of cardiologist following the implantation of a pacemaker [5]. In Slovenia we expect that to happen in the near future. One of the advances brought by the system is also unburdening the ERs as to a great deal of patients only advice suffices. With our future work we will get more information about prevalence and course of CV diseases in Slovene population. We will try to prove that use of TTE can improve cost benefit in treating patients with CV diseases and we would like to make it affordable to as many people as possible. Transmission of ECG signal through cellular phone system offers immediate consultation between cardiologist and a GP on a house call. Information technology and developing on line computer communication between medical staff is one of the main assignments of World Health Organization for the next millenium.

References

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