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Cardio On Line Europe S.r.l.

SEDE LEGALE Via S. Matarrese, 2/O - 70124 Bari
SEDE OPERATIVA Via P. Amedeo, 25 - 70121 Bari **TEL.** 080 5613578
CAP. SOC. €100.000,00 - **P. IVA N.** 04871010726 - **C.C.I.A.A. BARI N.** 290463/96
MAIL *info@cardioonlineeurope.com* - **PEC** *cardioonlineeurope@pec.it*

PUBBLICAZIONI

Pubblicazioni su riviste con impact factor

Journal of Thrombosis and Thrombolysis (impact factor 2006: 1.155)

1. Brunetti ND, De Gennaro L, Amodio G, Dellegrottaglie G, Pellegrino PL, Di Biase M, Antonelli G. Telecardiology applied to a region-wide public emergency health care service. J Thromb Thrombolysis. 2008 Jul 24; [Epub ahead of print]

Pubblicazioni di abstracts di congressi nazionali

1. Antoncecchi E, Antonelli G, De Luca I, Passantino A, Rizzo U, Amodio G, Parisi C, Mancini L, Antoncecchi V, De Giosa M, Carella L, "Telecardiologia a supporto del 118 – un'esperienza pugliese", G Ital Cardiol ambulatoriale 2005;3:129-138
2. Brunetti ND, Amodio G, De Gennaro L, Pellegrino PL, Dellegrottaglie G, Di Biase M, Antonelli G. "Telecardiologia applicata alla riduzione del time to treatment dello STEMI: dati dall'applicazione di metodiche di telecardiologia al servizio 118 della regione Puglia", G Ital Cardiol vol 7 Suppl 1-12 2006, 315S
3. Brunetti ND, Amodio G, De Gennaro L, Dellegrottaglie G, Pellegrino PL, Di Biase M, Antonelli G. "Telecardiologia applicata al servizio 118 della regione Puglia: 18 mesi e 27.000 pazienti", G Ital Cardiol vol 7 Suppl 1-12 2006, 126S
4. Brunetti ND, Amodio G, De Gennaro L, Dellegrottaglie G, Pellegrino PL, Di Biase M, Antonelli G. "Sensibilità e specificità dei sintomi in soggetti con sospetto infarto miocardico acuto o aritmia: analisi dei dati di una esperienza regionale di telecardiologia applicata al servizio regionale 118", G Ital Cardiol vol 7 Suppl 1-12 2006, 255S
5. Brunetti ND, Amodio G, De Gennaro L, Dellegrottaglie G, Pellegrino PL, Di Biase M, Antonelli G. "La telecardiologia per la diagnosi di infarto miocardico acuto nell'anziano". G Ital Cardiol vol 8 Suppl 1-12 2007, 229-230S

Pubblicazioni di abstracts di congressi internazionali

1. Brunetti ND, Dellegrottaglie G, De Gennaro L, Amodio G, Di Biase M, Antonelli G. "Acute myocardial infarction home diagnosis in a region wide telecardiology network for public emergency health care service: an experience from Italy" Eur Heart J Suppl 2006;27:140 (citato in Bax et al. Highlights of the 2006 scientific sessions of the European Society of Cardiology: Barcelona, Spain, September 2-5, 2006. J Am Coll Cardiol. 2006;48:2564-74. Epub 2006 Nov 28)
2. Brunetti ND, Amodio G, Dellegrottaglie G, De Gennaro L, Pellegrino PL, Di Biase M, Antonelli G. "Acute myocardial infarction home diagnosis in a region wide telecardiology network for public emergency health care service: an experience from Italy." Eur Heart J Suppl. 2007;28:788.
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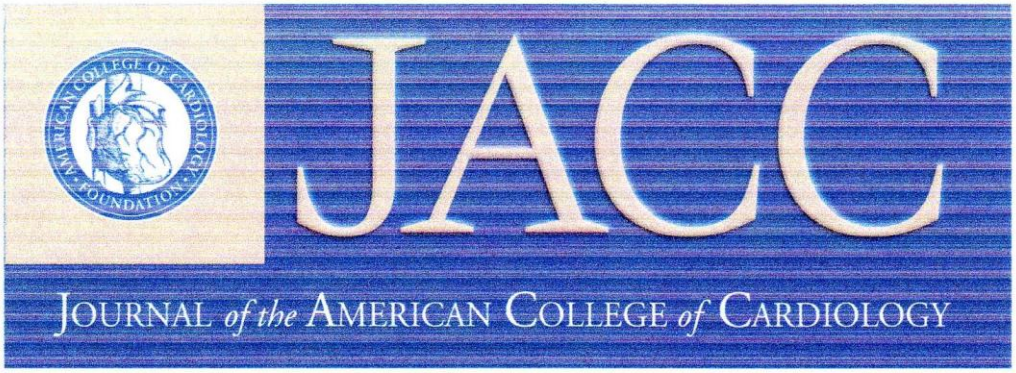
Partecipazione a Congressi nazionali e internazionali

1. Bari, "Congresso Nazionale di Cardiologia", Antonelli G
2. Roma, "Telecardioogia applicata al servizio 118 della Regione Puglia: 18 mesi e 27.000 pazienti", Brunetti ND, Amodio G, De Gennaro L, Dellegrottaglie G, Pellegrino PL, Di Biase M, Antonelli G
3. Barcellona, "World Congress of Cardiology 2006", Brunetti ND, Amodio G, De Gennaro L, Dellegrottaglie G, Pellegrino PL, Di Biase M, Antonelli G



Highlights of the 2006 Scientific Sessions of the European Society of Cardiology: Barcelona, Spain, September 2–5, 2006

Jeroen J. Bax, Bernard De Bruyne, Anselm K. Gitt, Steen Kristensen, Cecilia Linde, Don Poldermans, Fausto J. Pinto, Piotr Ponikowski, Bernard D. Prendergast, Enrico Abagiti-Rosei, Sidney C. Smith, Jr, Karin R. Sipido, Ernst E. van der Wall, Michal Tendera, and Michel Komajda

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MEETING HIGHLIGHTS

Highlights of the 2006 Scientific Sessions of the European Society of Cardiology

Barcelona, Spain, September 2–5, 2006

Jeroen J. Bax, MD, PhD,* Bernard De Bruyne, MD, PhD,† Anselm K. Gitt, MD,‡ Steen Kristensen, MD, DMSc,‖ Cecilia Linde, MD, PhD,¶ Don Poldermans, MD, PhD,# Fausto J. Pinto, MD, PhD,** Piotr Ponikowski, MD, PhD,†† Bernard D. Prendergast, MD,‡‡ Enrico Abagiti-Rosei, MD,§§ Sidney C. Smith, Jr, MD,‖‖ Karin R. Sipido, MD, PhD,¶¶ Ernst E. van der Wall, MD, PhD,* Michal Tendera, MD, ESC President,## Michel Komajda, MD (Chair of the Congress Program Committee)§

Leiden and Rotterdam, the Netherlands; Aalst and Leuven, Belgium; Ludwigshafen, Germany; Paris, France; Manchester, United Kingdom; Brescia, Italy; Aarhus, Denmark; Stockholm, Sweden; Lisbon, Portugal; Wroclaw and Katowice, Poland; and Chapel Hill, North Carolina

The World Congress of Cardiology (WCC) held in Barcelona (4 days, September 2006) was a joint meeting of the annual congress of the European Society of Cardiology (ESC) and the World Heart Federation (WHF), with more 25,500 active participants attending from 135 different countries. In particular, 25% of the total attendance was from Africa, North and South America, and Asia.

A record number of 229 prearranged sessions (30 meeting rooms running in parallel) were organized, including 12 with other societies including the American College of Cardiology and the American Heart Association. A total of 10,594 abstracts from 94 different countries were submitted, and 3,917 (37%) were selected for presentation, including 34% dedicated to basic science.

The theme of the meeting was "cardiovascular disease and ageing." The clinical profile and the management of elderly patients with cardiovascular diseases (CVDs) were addressed in 18 pre-arranged sessions and 125 scientific abstracts. In this document, the Global Health Agenda (a summary of special reports from the WHF plenary sessions) is discussed first, followed by the Euro Heart Survey program and Hotline sessions. Thereafter, a summary of the most important contributions presented at the different sessions is provided.

From the *Leiden University Medical Center, Leiden, the Netherlands; †Cardiovascular Center Aalst, OLV Clinic, Aalst, Belgium; ‖Institut fuer Herzinfarktforschung an der Universitaet Heidelberg, Ludwigshafen, Germany; ¶University Pierre et Marie Curie, Paris, France; #Aarhus University Hospital Skejby, Aarhus, Denmark; **Karolinska University Hospital, Stockholm, Sweden; ††Erasmus Medical Center, Rotterdam, the Netherlands; ‡‡Lisbon University, Lisbon, Portugal; §§Clinical Military Hospital, Wroclaw, Poland; ‖‖Wythenshawe Hospital, Manchester, United Kingdom; ¶¶Universita degli Studi di Brescia, Brescia, Italy; ‖‖University of North Carolina at Chapel Hill, Chapel Hill, North Carolina; ¶¶KUL, Leuven, Belgium; and the ##Silesian School of Medicine, Katowice, Poland. Dr. Bax has research grants from Guidant, Medtronic, GE Healthcare, and BMS Medical Imaging. Dr. Gitt is an advisor/consultant to BMS Medical Imaging, Eli Lilly, Essex Pharma, Glaxo, MSD, Pfizer, Sanofi-Aventis, and Servier. Dr. Linde was a member of the PI Medtronic study and receives research grants from Medtronic. Dr. Poldermans receives research grants from Merck and Novartis. Dr. Ponikowski is a consultant for VIFOR and receives honoraria for lectures for Merck.

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THE GLOBAL HEALTH AGENDA

Cardiovascular diseases are now the leading cause of death worldwide claiming more than 17.5 million lives in 2005. The greatest numbers of CVD deaths (80%) occur in low- and middle-income countries where the prevalence of CVD is increasing at an alarming rate and health care resources are limited. For inexplicable reasons, the United Nations has not included CVD and chronic diseases among the Millennium development goals, designed to reduce poverty and promote health in developing countries by the year 2015. Limited funds mean limited action directed at prevention and control. This situation must be corrected if progress is to be recognized in preventing the early morbidity and mortality from CVD worldwide.

In an adult population, poor health due to CVD threatens sustainable economic growth and has an especially crippling effect on countries with developing economies. In 2000, the productive years of life lost due to CVD occurring in the workforce of 5 selected countries included 1.1 million in Brazil, 0.3 million in South Africa, 3.3 million in Russia, 6.7 million in China, and 9.2 million in India for a total of 20.1 million. It is estimated that, between 2005 and 2015, CVD and its risk factors such as hypertension and diabetes will impose huge costs through lost productivity and reduce the gross domestic product in most low- and middle-income countries that are now experiencing rapid economic growth. Obesity and diabetes are 2 risk factors for CVD that are growing in prevalence worldwide. Their incidence among children is of particular concern as childhood obesity generally predicts adult obesity. Childhood obesity is increasing across all continents such that 10% of the world's childhood population is now overweight or obese. In many Westernized countries, the prevalence of children who are overweight is as high as 20% and increasing prevalence is now occurring in many developing countries. Type 2 diabetes in childhood, secondary to obesity, is increasingly common in many countries, and its complications, especially the increased risk of CVD, greatly shorten the life expectancy for many in the obese childhood population.

Africa faces now a double burden, the combined epidemics of communicable diseases and emerging chronic diseases. In Africa, CVD is major component of chronic diseases and includes hypertension, stroke, cardiomyopathy, rheumatic heart disease, and the increasing prevalence of ischemic heart disease. Prevention must be the cornerstone of effective clinical and public health intervention. For example, only 60 children need to be treated with penicillin to prevent 1 case of rheumatic heart disease. Hypertension prevention and control can eliminate most stroke morbidity and mortality. In Africa, increased emphasis must be made on CVD risk factor awareness, surveillance, advocacy, and adherence to best practices.

Worldwide, more than 15 million people have rheumatic heart disease and at least 350,000 related deaths occur yearly. The WHF sponsors demonstration sites and training workshops in the South Pacific and is and is developing sites in Africa to assist with the development of critically needed register-based programs. Portable echocardiography is increasingly available in countries with developing economies and is the only reliable method for the detection of subclinical rheumatic heart disease. Vaccines for the prevention of rheumatic heart disease are now in early clinical trials and hold great potential if effective, safe, and affordable.

The mortality from CVD in China has more than doubled during the last 20 years. The WHF sponsors a large secondary prevention program involving hospitals in all 31 provinces and regions of China. The goal is to improve utilization of secondary prevention therapies known to improve outcomes for patients hospitalized with CVD. Current utilization of these therapies is being determined for hospitals in each region, after which strategies designed to operate under limited resources will be initiated to improve their implementation. It is anticipated that this program will provide important information to assist in improving the outcome for patients with CVD in China and serve as a model for other low- and middle-income countries.

Abbreviations and Acronyms

ACE	= angiotensin-converting enzyme
ACS	= acute coronary syndrome
CRT	= cardiac resynchronization therapy
CVD	= cardiovascular disease
ESC	= European Society of Cardiology
MRI	= magnetic resonance imaging
MSCT	= multislice computed tomography
NYHA	= New York Heart Association
PCI	= percutaneous coronary intervention
SPECT	= single-photon emission computed tomography
STEMI	= ST-segment elevation myocardial infarction
VHD	= valvular heart disease
WCC	= World Congress of Cardiology
WHF	= World Heart Federation

EURO HEART SURVEY

The Euro Heart Survey program of the ESC provides systematic information on the management of patients with CVD in clinical practice in Europe. During the WCC 2006, data of current surveys were presented in 5 symposia covering the following topics: ageing and CVD, acute coronary syndromes (ACS), heart failure, percutaneous coronary intervention (PCI), and atrial fibrillation.

Aging and CVDs. The population is ageing rapidly, with 13.7% of the European population aged 65 years or older, which is twice the world level. With age, the prevalence of death due to CVD increases steeply up to about 40% in the elderly. In the second Euro Heart Survey on ACS, 40% of consecutive patients were older than 70 years. The elderly less often received reperfusion and acute adjunctive treatment and had 3 times higher 30-day and 1-year mortality than patients younger than 70 years. In the PCI survey, 19% of all patients undergoing PCI were older than 75 years (mean age 79 years), with 75% having multivessel disease. Although the rate of complications was low, the elderly suffered from bleeding and renal failure requiring dialysis twice as often as younger patients. In the survey on valvular heart disease (VHD), the most common valve diseases were aortic stenosis and mitral regurgitation. In patients older than 75 years, surgery was denied in 33% with severe aortic stenosis and in 64% with severe mitral regurgitation.

ACS. The comparison of the 2 Euro Heart Surveys on ACS-I in 2000 and ACS-II in 2004 demonstrated a significant improvement in adherence to current treatment guidelines with an increase of primary reperfusion for ST-segment elevation myocardial infarction from 56% to 64% and a shift from thrombolysis to primary PCI. Adjunctive medical treatment with beta-blockers, angiotensin-converting enzyme (ACE) inhibitors, clopidogrel, and statins improved over the years. This improvement in adherence to guidelines was associated with a trend towards lower 30-day and 1-year mortality in clinical practice.

PCI. The Euro Heart Survey on PCI enrolled 13,152 consecutive patients in 134 centers of 39 ESC member countries between June 2005 and January 2006. The indications for the intervention were ACS in 57% of all patients. Two-thirds of the patients undergoing PCI had multivessel disease. However, in 69% of all cases, 1 lesion was treated, probably reflecting incomplete revascularization. Stenting rate in clinical practice was 93%; a total of 41% of patients received drug-eluting stents with great variation between countries from below 10% up to 80%. The use of diagnostic devices like intravascular ultrasound or pressure/flow wires and therapeutic devices like distal protection devices, thrombectomy devices, or rotablation was below 2% in the overall population.

Heart failure. The Euro Heart Survey on Heart Failure-II enrolled patients with acute heart failure. Patients with acute de novo as compared with acute decompensated chronic heart failure had higher in-hospital mortality but lower 1-year mortality. In these subgroups, chronic treatment with beta-blockers and ACE inhibitors was associated with a significant reduction in 1-year mortality in unselected patients in clinical practice. The medical treatment with ACE inhibitors, beta-blockers, and spironolactone in patients with heart failure significantly improved between the 2 Euro Heart Surveys on heart failure in 2000 and 2004. However, the used dosages of particularly beta-blockers and ACE inhibitors remained unchanged over the years at a mean of only 50% of the recommended dosages derived from randomized controlled trials.

Atrial fibrillation. The Euro Heart Survey on atrial fibrillation revealed an under-treatment with long-term oral anticoagulation in 26% of patients with atrial fibrillation. This under-treatment was associated with a 2-fold increase of thromboembolic events during 1-year follow-up. Especially in paroxysmal atrial fibrillation, the rate of stroke within 1 year after pharmacologic or electrical cardioversion was 3-fold higher than in persistent atrial fibrillation. This higher incidence in stroke may have been related to a lower rate of effective oral anticoagulation and a higher rate of repeated cardioversions in this patient subgroup.

HOTLINES, NON-INTERVENTIONAL

The 2-year follow-up results of the international REACH (REduction of Atherothrombosis for Continued Health) registry were presented, and international differences were addressed. The study included more than 68,000 patients enrolled from 5,592 sites of 44 countries. This worldwide registry provides detailed information on risk factors, medical treatment, achievement of therapeutic goals, and long-term outcome among different health care systems. Results showed that, during 2-year follow-up, 20% of patients suffered a major event or were hospitalized. The incidence of cardiovascular death was 2.6% as compared with 6.2% for the combined end point of cardiovascular death, stroke, or myocardial infarction. Patients from Eastern Europe or the Middle East had the highest incidence of events, with 33% of the enrolled patients suffering a major event.

In the WAVE (Warfarin Antiplatelet Vascular Event) study, patients with peripheral atherosclerotic disease from 80 centers in 7 countries were randomized to receive either antiplatelet therapy only (n = 1,081) or antiplatelet therapy combined with oral anticoagulants (n = 1,080). Patients with peripheral atherosclerotic disease are at increased risk of late cardiovascular events, and the combined strategy has been shown to be effective in patients with CVD. The aspirin dose varied between 81 and 325 mg. The oral anticoagulant therapy was of moderate intensity aiming at an international normalized ratio of 2 to 3. Results after 42 months follow-up showed that 12.2% of patients with combined therapy suffered cardiovascular death, infarction, or stroke compared with 13.3% of patients receiving aspirin only ($p = 0.49$). In addition, 4% of the patients with combined therapy experienced life-threatening bleeds compared with 1.2% in the aspirin only group ($p < 0.001$). It was concluded that the combined therapy offered no beneficial effect (with higher bleeding risk) in patients with peripheral atherosclerotic disease.

The effect of homocysteine lowering in patients with chronic vascular disease was studied in the HOPE-2 (Heart Outcomes Prevention Evaluation) trial. A total of 5,522 patients were randomized to treatment with folic acid (2.5 mg), vitamin B_6 (50 mg), and vitamin B_{12} (1 mg), or placebo. During 5-year follow-up, no difference was observed in cardiovascular death, infarction, or stroke in treated patients (18.8%) or the placebo group (19.8%), indicating no beneficial effect of vitamin supplementation.

The CIBIS (Cardiac Insufficiency Bisoprolol Study)-III evaluated the optimum sequence of initiating treatment of heart failure patients: starting with bisoprolol or enalapril. In a subanalysis, the incidence of sudden death was compared. A total of 1,010 patients with moderate heart failure were randomized to either starting with bisoprolol or enalapril for 6 months, followed by their combination up to 24 months. During the first year, the sudden death rate was marginally lower (3.1% vs. 5.7%, $p = 0.049$) in the patients receiving bisoprolol first. However, during the entire study period, no differences in the incidence of sudden death were observed. The results of initiating therapy with bisoprolol are promising, but need confirmation in a larger population.

The effect of patent foramen ovale closure in patients with invalidating migraine has been investigated in the MIST (Migraine Intervention with STARFlex Technology [NMT Medical, Inc., Boston, Massachusetts]) trial. Patients were randomly assigned to a closure device or sham intervention. The study confirmed for the first time the high rate of right-to-left shunt in patients with migraine (37%). The primary end point, complete cessation of migraine, was not reached. A significant decrease in the total disease burden was shown: 42% of patients with closure device reported a decrease of at least 50% of the number of headache days, as compared with 23% with sham operation. These results triggered the launch of the MIST-II trial that will aim at using a resorbable closure device in 600 patients.

HOTLINES, INTERVENTIONAL

The effect of age on the 1-year mortality after revascularization in patients with multivessel coronary artery disease was analyzed in the ARTS (Arterial Revascularization Therapy Studies) trials. Among the patients who underwent bypass surgery, a trend towards an increased mortality with age was observed whereas this trend was not seen after PCI with bare-metal or drug-eluting stents.

The antiproliferative effects of a new everolimus-eluting stent (Xience V stent; Abbott, Abbott Park, Illinois) was tested against the paclitaxel-eluting stent (Taxus, Boston Scientific, Natick, Massachusetts) in patients with 1 or 2 stenoses. At 6 months, the everolimus stent was associated with a significantly smaller neointimal hyperplasia than the paclitaxel-eluting stent. In 30% of lesions, the everolimus-eluting stent was associated with a negative angiographic late loss. The study was not powered to draw conclusions on clinical outcome.

Paralleling the development of new drug-eluting stents, several recent bare-metal stents have good track records in terms of clinical outcome. This was illustrated by a prospective randomized trial in which the rate of major adverse cardiac events was equally low after implantation of a biolimus A9 eluting stent (5.4%) or bare-metal stent (5.0%).

The 18-month clinical outcome data of the Basket (Basel Stent Cost-Effectiveness Trial) study were reported. The trial consists of a randomized comparison between drug-eluting stents (sirolimus- and paclitaxel-eluting stents) and bare-metal stents in 826 consecutive patients. The data suggest that the benefit (in terms of total major adverse cardiac events, and survival free of death or infarction) is significantly larger with drug-eluting stents as compared with after bare-metal stents in small vessels (<3 mm) or bypass grafts. This advantage was no longer present or even reversed in larger native vessels (≥3 mm). A detailed cost-effectiveness study performed on the same cohort of patients indicates that, if drug-eluting stents are used in all patients, incremental cost-effectiveness ratio to avoid 1 major adverse cardiac event is high (>€50,000). In contrast, the incremental cost-effectiveness ratio to avoid 1 major adverse cardiac event is favorable if drug-eluting stents are used only in patients with small stents or bypass graft stenting.

The 5-year clinical outcome data of the patients included in the RAVEL (Randomized Study with Sirolimus-Coated Bx Velocity Balloon-Eexpandable Stent in the Treatment of Patients With De Novo Native Coronary Artery Lesion) study have been presented. The study, which was powered for an angiographic end point had shown that sirolimus-eluting stents virtually abolish neointimal hyperplasia: after 6 months, the angiographic late loss was −0.01 mm after sirolimus-eluting stenting versus 0.80 after bare-metal stenting. After 5 years, the number of target vessel revascularizations remains significantly lower in the sirolimus-eluting stent group than in the bare-metal stent group. In contrast, a trend towards a higher rate of death or infarction was reported.

Two meta-analyses sparked a lot of discussion. Both are based on earlier randomized studies comparing sirolimus- or paclitaxel-eluting stents to their bare-metal counterpart (more than 7,000 patients). The first meta-analysis showed a relative excess in combined death or Q-wave myocardial infarction in patients who received a first generation drug-eluting stent. The second meta-analysis focused on the rate of non-cardiac death, which tended to be higher with first generation drug-eluting stents (particularly sirolimus-eluting stents) than bare-metal stents. However, before drawing definitive conclusions, more details on the exact methodology used for these meta-analyses should be awaited. Nonetheless, the data presented during the meeting points towards a more tailored use of bare-metal and drug-eluting stents.

ACS

Diagnosis. Early diagnosis and triage are essential in treatment of ST-segment elevation myocardial infarction (STEMI). A British registry revealed that delay of thrombolysis was a predictor of increased mortality in STEMI patients (1). Time-to-reperfusion treatment can be reduced, when the patients can be directed to primary PCI based on pre-hospital diagnosis on-site or by wireless electrocardiogram transmission to the PCI center (2,3). Applying telecardiology to a large region also shortened diagnostic delay and diminished the number of improper hospitalizations (4).

Therapy. A French registry showed that guideline-recommended therapy was underutilized in acute infarction patients older than 80 years (5).

New data from the OASIS (Organization to Assess Strategies for Ischemic Syndromes)-5 study revealed that the 50% decrease in early bleeding with fondaparinux compared with enoxaparin was consistent regardless the use of unfractionated heparin, and that this lower risk of bleeding was associated with reduced long-term mortality (6). A randomized trial in 393 patients with non-STEMI treated with aspirin, clopidogrel, and invasive therapy revealed no benefit of eptifibatide (7).

In the recent publications, neither distal protection nor thrombectomy improved outcome during primary PCI. Accordingly, a meta-analysis showed no benefit of thrombectomy and distal protection (8). However, in a randomized trial including 368 STEMI patients, thrombus aspiration before primary PCI improved myocardial microcirculation as evaluated by myocardial blush rate (9).

Registries suggested that clopidogrel is beneficial in the treatment of STEMI (10,11). In a randomized study in patients undergoing PCI, a maintenance dose of 150 mg daily was shown to inhibit adenosine-diphosphate-induced platelet aggregation more efficiently than the usual dose of 75 mg daily (12).

Prognosis. Electrocardiogram data from the ASSENT (ASsessment of Safety and Efficacy of New Thrombolytic)-4 PCI study, where facilitated primary PCI with tenecteplase was found to be associated with a worse outcome than primary PCI without thrombolysis, revealed that resolution of ST-segment elevation at 60 min after randomization occurred more often in patients treated with facilitated PCI (13). However, at the time interval from 60 to 180 min, tenecteplase-treated patients had less ST-segment resolution, and this was associated with an in-

creased incidence of reinfarction and may explain the rather unexpected poor outcome in patients treated with facilitated PCI (13).

Reperfusion arrhythmias after primary PCI were associated with a favorable prognosis (14). Acute coronary syndrome patients presenting with left bundle branch block have a higher mortality than patients presenting with ST-segment elevation (15).

Analysis of the combined data from the OASIS-5 and -6 trials showed that low baseline hemoglobin levels were related to a poor outcome and risk of bleeding, which was significantly lower with fondaparinux than with enoxaparin/unfractionated heparin/placebo (16). Also, in STEMI patients undergoing primary PCI (17,18), anemia at presentation was associated with poor outcome. An increased white cell count at baseline was also associated with poor outcome in patients undergoing primary PCI (19).

HEART FAILURE

A substantial number of registries on heart failure were presented, with a focus on the elderly patients (see the preceding text Euro Heart Survey). The main conclusions of these trials were that heart failure is frequent among the elderly and that these patients are still poorly treated although they would equally benefit from life-saving therapies as compared with younger patients. In 1 registry, consisting of 1,054 heart failure patients most of which were older than 70 years, adherence to pharmacotherapy as recommended by the ESC guidelines was a strong and independent predictor of superior survival, and this benefit was irrespective of age, gender, and left ventricular function (20).

Next, more pathophysiological studies were presented. It is known that both the immune system and autonomic imbalance are key elements of the complex pathophysiology of heart failure. These factors are traditionally considered in isolation, but new evidence was presented supporting that immune dysfunction (as evidenced by elevated levels of proinflammatory cytokines) correlated with depleted vagal tone (21). In addition, an increase in cholinergic signaling with pirydostigmine (reversible acetylcholinesterase inhibitor) improved autonomic balance with concomitant attenuation of immune activation of circulating immunocompetent cells (21). Whether restoration of parasympathetic systems will ultimately lead to restoration of autonomic and immune control needs further study.

Testosterone deficiency is a component of impaired anabolic function in men with heart failure and predicts exercise intolerance and poor quality of life. A double-blind, placebo-controlled parallel study of testosterone replacement therapy (up to 12 months) at physiological doses was undertaken in 76 men with symptomatic heart failure (New York Heart Association [NYHA] functional class II to IV, left ventricular ejection fraction 32%) (22). The therapy was safe and significantly improved heart failure symptoms, functional capacity, and increased handgrip strength. The mechanisms underlying these findings merit further study.

Anemia is frequently observed in heart failure and is associated with increased morbidity and mortality. Preliminary studies have suggested that correction of anemia with erythropoiesis-stimulating proteins may improve exercise capacity, symptoms, and quality of life. Combined analysis of 2 randomized, double-blind, placebo-controlled studies was presented, in which 266 anemic patients (hemoglobin level ≥9.0 g/dl and ≤12.5 g/dl) with symptomatic heart failure were treated with darbepoetin alfa (long-acting erythropoiesis-stimulating protein) and 209 received placebo (23). Therapy with darbepoetin alfa was well-tolerated, increased and maintained hemoglobin level within the target range, but did not significantly improve quality of life or symptoms. Interestingly, however, there was strong trend towards improvement in composite outcome of morbidity and mortality. In another study, 35 symptomatic heart failure patients with iron deficiency were randomly assigned to a 16-week therapy with intravenous iron sucrose versus no treatment (24). Iron repletion with iron sucrose was safe, well tolerated, and associated with improvements in exercise capacity and symptoms. Of note, the benefits were particularly evident in anemic patients, showing a mean increase in peak Vo_2 of 4.0 ml/kg/min.

Whether targeting inflammation with a novel, broad spectrum immune modulating therapy would reduce mortality and hospitalization rate in heart failure patients was evaluated in the ACCLAIM (Advanced Chronic Heart Failure Clinical Assessment of Immune Modulation Therapy) trial. Immune modulating therapy was based on the novel device—Celacade System (Vasogen Inc., Mississauga, Ontario, Canada)—that delivers controlled oxidative stress to a patients' blood sample ex vivo, and results in apoptosis of autologous cells; the blood sample is then administered intramuscularly, which subsequently triggers an anti-inflammatory response. The ACCLAIM trial randomized more than 2,400 heart failure patients (70% in NYHA functional class III to IV, left ventricular ejection fraction 23%, all with optimized medical therapy with 94% receiving ACE inhibitors and/or angiotensin receptor blockers and 87% receiving beta-blockers) to treatment with either immune modulating therapy or placebo. Immune modulating therapy appeared safe and well-tolerated, but the primary end point (mortality and cardiovascular hospitalization) was not met. However, immune modulating therapy was effective in 2 pre-specified subgroups: patients with NYHA functional class II and patients without history of previous infarction.

HYPERTENSION

Epidemiologic studies focused on the prevalence and control of risk factors. A large annual survey (Cardiomonitor) in patients with CVD was presented, with data obtained by general practitioners and cardiologists from all over the world (25). Results in 25,000 diabetic patients indicated that only 1 of 5 patients in Europe and 2 of 5 in the U.S. had well-regulated systolic blood pressure (≤130 mm Hg), indicating that, with the rising incidence of diabetes worldwide, there is also urgent need for better blood pressure control.

Hypertension is in large part determined by genetic factors. In 215 young patients with type 1 diabetes, it was shown that blood pressure progression was related to angiotensinogen gene polymorphism (26). Another study revealed that the atrial natriuretic peptide promoter gene variant was associated with higher blood pressure at young age (27). These individuals also showed a predisposition to develop cerebrovascular events.

Pathophysiological mechanisms in hypertension were also investigated. High adrenergic tone was associated with a neuroplastic reduction in sympathetic nerve density, with suppression of nerve growth factor being the possible mediating mechanism (28). In another study, an altered structure of subcutaneous small resistance arteries (i.e., increased wall thickness to lumen diameter ratio) was shown to be associated with increased morning rise of blood pressure, a factor of enhanced risk, possibly because of amplification of hypertensive stimuli in the early morning (29).

Among indicators of preclinical organ damage in hypertension, the importance of left ventricular hypertrophy as an independent risk factor is well recognized. The results of the LIFE (Losartan Intervention For Endpoint reduction in hypertension) study confirmed that left ventricular geometry during treatment adds information on risk of major cardiovascular events (with concentric geometry associated with the highest risk) (30).

In general, prevention or regression of organ damage should be considered a specific goal of antihypertensive treatment. New therapeutic approaches were proposed. An inhibitor of rho-kinase was shown effective for preventing renal and cardiac damage in a rat-model of malignant hypertension (31). In man, the efficacy and safety of aliskiren (the first of a new class of orally effective renin inhibitors) were assessed in a pooled analysis from large randomized, double-blind, clinical studies, involving more than 700 patients. It was shown that doses of 150 to 300 mg daily effectively reduced blood pressure without significant side effects (32).

Hypertension is often associated to metabolic risk factors and abdominal obesity. Pooled data from trials with rimonabant (the first selective cannabinoid CB1 receptor blocker) confirmed its efficacy in improving glucose and lipid metabolism and in reducing body weight over 1 year of treatment (33). The ASCOT (Anglo-Scandinavian Cardiac Outcome Trial) study confirmed that treatment with diuretics and beta-blockers is mostly associated with a greater incidence of new-onset diabetes, particularly in those at higher risk. Finally, the results of the EUROACTION program have shown that involving multidisciplinary teams in delivering the prevention message leads to a significant reduction in cardiovascular risk factors as compared with the usual preventive approach. This is a strong message, indicating that it is achievable to improve significantly the control of risk factors and, hence, the burden of CVD in clinical practice.

ELECTROPHYSIOLOGY AND PACING

Cardiac resynchronization therapy (CRT). Many original scientific contributions were dedicated to CRT. Further analysis of the CARE-HF (Cardiac REsynchronization-Heart Failure trial) data aimed at prediction of sudden cardiac death (34). Severe mitral regurgitation at 3 months follow-up appeared a significant predictor of sudden death whereas CRT was protective against sudden death.

In another subanalysis of the CARE-HF study, it was shown that diabetic patients had similar benefit from CRT as compared with non-diabetic patients (35).

Randomized studies on CRT in atrial fibrillation are sparse, but observational studies suggest similar benefit to patients in sinus rhythm. An unresolved issue is whether patients with atrial fibrillation should undergo atrioventricular node ablation to ensure capture. In a 4-year open study with 243 heart failure patients, superior survival was demonstrated in patients who underwent atrioventricular node ablation (annual mortality 4.3% vs. 15.2% in non-ablated patients, $p < 0.001$) (36).

Atrial fibrillation. The new American College of Cardiology/American Heart Association/ESC guidelines on management of atrial fibrillation indicate that high-risk factors for thromboembolism are previous stroke, transient ischemic attack or embolism, mitral stenosis, and prosthetic valves. Moderate risk factors are age ≥75 years, hypertension, heart failure, left ventricular ejection fraction ≤35%, and diabetes. Oral anticoagulation is recommended (class I indication) in the presence of any high-risk factor or more than 1 moderate-risk factor. The risk/benefit of oral anticoagulation in relation to these risk factors was addressed in 290 elderly patients (median age 82 years) (37). For elderly patients with only 1 moderate risk factor, the number needed to treat (n = 58) and harm (n = 51) was relatively low, and the indication for oral anticoagulation may be questionable. For patients with 4 moderate- and 1 high-risk factor, the number needed to treat (n = 16) and to harm (n = 29) was relatively low indicating that oral anticoagulation should be individualized in these elderly patients. For the remaining patients with 2 to 3 moderate risk factors, oral anticoagulation should be provided.

The ACTIVE-W (Atrial Fibrillation Clopidogrel Trial with Irbesartan for Prevention of Vascular Events-Warfarin) substudy reported on the risk of stroke or thromboembolism in paroxysmal versus persistent/permanent atrial fibrillation (38). These patients had on the average 1.7 to 2 moderate-risk factors for thromboembolism. The risk of stroke or thromboembolism was compa-

rable in both groups (2.0 in paroxysmal vs. 2.2 in persistent/permanent/100 person-years), and oral anticoagulation in both groups was clearly superior to the combination of clopidogrel and aspirin in reducing the risk.

Polyunsaturated fatty acids reduced the risk for ventricular arrhythmias and sudden death in post-myocardial infarction patients. The properties of these fatty acids in reducing the risk of atrial fibrillation relapse after cardioversion was evaluated (39); the 1-year relapse risk after cardioversion was 23% in patients who received 1 g fatty acids in addition to conventional therapy, as compared with 66% in a control group ($p < 0.001$).

Devices and ablation therapy. The PEOPLE (Prospective Evaluation Of Pacemaker Lead Endocarditis) study (44 centers, 6,134 device implantations) focused on the need for antibiotic prophylaxis during device implantation (40). It was shown that the risk of infection was significantly lower in patients receiving antibiotic prophylaxis (1.3% vs. 0.6%, p = 0.03) (40).

In ablation therapy, recurrence after radiofrequency catheter ablation of accessory pathways occurs and generally a time window of 30 min is used to ensure absence of recurrence. This was evaluated in 439 ablations (419 patients), and the risk of recurrence after 10 min was 0.4% and 1.4% for left- and right-sided accessory pathways, respectively, and 3.8% for superior, peri-His and medioseptal locations (41).

VHD

The prevalence of VHD is rising, particularly in the ageing population. This group is characterized by under-referral for appropriate intervention associated with excess morbidity and mortality.

Calcification underlies degenerative VHD, and numerous groups seek underlying mechanisms. Human valve cells exposed to osteogenic media demonstrated increased activity of alkaline phosphatase, suggesting differentiation to an osteoblastic phenotype. These effects are abolished by atorvastatin, which decreased cytokines and increased adenosine triphosphate breakdown and adenosine formation (42). Similarly, in patients with aortic stenosis, levels of fetuin A (an inhibitor of vascular/soft-tissue calcification already implicated in vascular disease in dialysis recipients) were shown to inversely correlate with valve calcification and predicted disease progression (43,44). While clinical data are conflicting and randomized trials awaited, increased understanding of these pathways may demonstrate novel therapeutic targets.

Difficult clinical situations are commonplace in regurgitant VHD where a long symptom-free period often accompanies irreversible decline in left ventricular function. Although international guidelines provide criteria for early surgery, additional information can be obtained by indexing left ventricular end-systolic diameter to body surface area (45).

Percutaneous mitral commissurotomy is the treatment of choice for patients with mitral stenosis suitable for the procedure. Single-center data concerning 3,709 patients demonstrated good immediate results in 89% of patients with low mortality (0.4%), technical failure (1.1%), or severe mitral regurgitation (4.4%) (46). These excellent results were applicable worldwide despite varying patient characteristics (47), and long-term follow-up was similar to closed commissurotomy, the surgical alternative (48).

In addition, 1 study reported on the successful application of percutaneous mitral valve repair in 12 subjects with severe regurgitation and preserved left ventricular function (49). Another study was presented on 36 patients with severe aortic stenosis and advanced comorbidity who underwent successful percutaneous valve implantation; the adverse event rates were 19% at 1 month and 28% at 6 months follow-up, without valve migration (50). The percutaneous valve techniques are promising, but more data are needed.

Numerous factors predict adverse outcome in infective endocarditis. It was shown that diabetic patients had an increased incidence of staphylococcal and enterococcal infections with a higher mortality and incidence of heart failure and multi-organ failure (51). In another registry, an incidence of cerebrovascular complications of 22% in infective endocarditis was demonstrated using computed tomography of the brain (52). The benefits of early surgery in these high-risk patients were confirmed in summative data from the international collaboration on endocarditis (53).

IMAGING: ECHOCARDIOGRAPHY

Different studies on new technical developments and new clinical applications were presented. A contrast echocardiographic study evaluated the value of myocardial viability to predict outcome in patients with acute infarction. A total of 76 patients underwent vasodilator low power myocardial contrast echocardiography at 7 ± 2 days after thrombolysis (54). It was shown that the extent of residual myocardial viability was the only independent predictor of mortality and reinfarction.

Strain rate imaging was used to discriminate different degrees of myocardial necrosis and to identify segments with potential functional recovery in 18 patients with acute anterior infarction; the results were compared with contrast-enhanced magnetic resonance imaging (MRI) (55). Strain rate imaging could differentiate between non-transmural and transmural necrosis. The sensitivity, specificity, and area under the receiver operator characteristic curve to identify those segments with potential functional recovery (defined as <50% of scar tissue on contrast-enhanced MRI) were 74%, 71%, and 0.76, respectively. Strain rate imaging appears promising to evaluate the transmurality of necrosis and detect non-viable myocardium after acute infarction.

Real-time 3-dimensional echocardiography was used to assess the effects of CRT (56). Twenty patients were studied before and 6 months after CRT implantation. The dyssyn-

chrony index, defined as the standard deviation of the time it takes for each of the 16 left ventricular segments to reach their minimum volume, as well as the left ventricular ejection fraction were calculated. From the analysis of the regional volumes, an evaluation of the total volume change of the left ventricular segments that present with delayed contraction ("total delayed volume") was also feasible. In the responders (n = 14), significant reductions were observed in the left ventricular volumes and the dyssynchrony index with an increase in left ventricular ejection fraction (9 ± 2%) after CRT. A significant reduction in the total delayed volume was also observed, and a strong correlation was demonstrated between the dyssynchrony index and the total delayed volume. It was concluded that CRT has a significant impact on several functional and anatomical echocardiographic left ventricular parameters. Novel variables, such as the total delayed volume, could potentially offer a more extensive evaluation of the effects of CRT in the future.

Speckle-tracking echocardiography, which is a new strain-based method to assess left ventricular function, was used to evaluate left ventricular rotation and untwisting in 44 asymptomatic obese subjects (57); results were compared with standard tissue Doppler imaging. Obese subjects demonstrated reduced systolic left ventricular torsion and basal rotation, but preserved systolic apical velocities. The untwisting rotational velocities in diastole were similarly reduced. Systolic longitudinal tissue velocity on tissue Doppler imaging correlated significantly with left ventricular basal rotation and overall torsion. Left ventricular torsion also correlated with waist. Basal rotation and left ventricular torsion were significantly reduced even in patients without left ventricular dysfunction on tissue Doppler imaging. The novel speckle-tracking technique may be more sensitive to assess subclinical myocardial disease in obese patients as compared with standard tissue Doppler imaging.

IMAGING: NUCLEAR CARDIOLOGY, MRI, AND COMPUTED TOMOGRAPHY

The strength of nuclear cardiology remains risk stratification. The prevalence of perfusion abnormalities on single-photon emission computed tomography (SPECT) imaging in patients with diabetes was addressed in a European multicenter registry (58). Diabetic patients were prospectively recruited from 17 centers in 6 European countries; 539 patients underwent a rest-stress perfusion-gated SPECT examination. A history of CVD, male gender, body mass index >25 kg/m², alcohol consumption were independent predictors of abnormal SPECT studies. It was concluded that gated SPECT imaging permits further risk stratification in addition to the traditional risk factors in patients with diabetes.

Two studies used nuclear imaging to evaluate novel therapies. Metabolic imaging with F18-fluorodeoxyglucose was used to detect viability and scar tissue to better predict response to CRT (59). Sixty-one consecutive patients with advanced heart failure, left ventricular ejection fraction <35%, QRS duration >120 ms, and chronic CVD were included. The presence of myocardial viability was directly related to an increase in left ventricular ejection fraction after 6 months of CRT. The optimal cutoff value to predict clinical response to CRT was identified at an extent of 11 viable segments or more (in a 17-segment model), yielding a sensitivity of 74% and a specificity of 87%.

A second study evaluated the effect of intracoronary infusion of autologous bone marrow stem cells in patients with acute infarction (60). Patients were randomized either to cell therapy or a control group. The patients who received cell therapy showed superior left ventricular function and perfusion as compared with control subjects at 12 months follow-up.

Magnetic resonance imaging has become the gold standard for assessment of cardiac function and myocardial scar by contrast-enhanced imaging. Despite excellent diagnostic accuracy of contrast-enhanced MRI, the prognostic significance is unknown. This was addressed in a multicenter trial (61). In 1,493 patients, the prognostic value of MRI assessment of left ventricular ejection fraction and scar tissue was evaluated. The median follow-up time was 2.4 years, and the primary end point was all-cause mortality. On univariate analysis, the only clinical predictors were older age and history of CVD. Magnetic resonance imaging predictors were left ventricular ejection fraction and the presence/extent of scar tissue. On multivariate analysis, age, left ventricular ejection fraction, and extent of scar tissue were independent predictors of all-cause mortality.

Similarly, the prognostic value of contrast-enhanced MRI was assessed in 101 patients with dilated cardiomyopathy (62). Mid-wall fibrosis was present in 35% of patients, was the single significant predictor of death/hospitalization, but also predicted sudden cardiac death/ventricular tachycardia. Both of these studies (61,62) suggest a potential role for MRI in risk stratification of patients with ischemic or dilated cardiomyopathy.

Multislice computed tomography (MSCT) permits non-invasive assessment of the coronary arteries. This concept was applied in patients referred for valve surgery (63). In these patients, MSCT was used to exclude or detect CVD, to decide whether valve surgery should be combined with bypass surgery or not. In 70 patients, the sensitivity and specificity of MSCT to detect significant stenoses were excellent, indicating that MSCT may replace invasive angiography in these patients.

In another study, the accuracy of 64-slice MSCT for assessment of plaque composition was compared with intravascular ultrasound (64). Multislice computed tomography correctly detected 83% of non-calcified plaques, 97% of mixed plaques, 95% of calcified plaques. Multislice computed tomography may, thus, be helpful in assessment of plaque composition.

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In addition to evaluation of coronary arteries, MSCT also permits detection of potential aortic valve stenosis (65). In 30 patients with aortic stenosis, the valve area on MSCT was closely related to echocardiography.

BASIC SCIENCE

In the area of stem cell therapy, several experimental studies reported on potential new sources of multipotent cells for cardiac repair, such as cells from amniotic fluid (66), adipose tissue (67), or testis (68). The spermatogonial cells seem to have a similar potential as embryonic stem cells for differentiation into functional cardiac myocytes, a desired end point not as easily reached by cells from other sources. Pre-differentiation may facilitate the incorporation of embryonic cells into the myocardium (69), but for xenogeneic transplant several immunological hurdles still need to be taken (70), not counting the ethical issues to be addressed. Adult human cardiac tissue as obtained during atrial biopsies can also be a source of multipotent stem cells (71), or could contain cells that drive vasculogenesis as during embryonic development. Injection of such epicardium-derived cells improved post-myocardial infarction remodeling as shown in a murine model of myocardial infarction (72). The postulated paracrine effects of stem cell therapy after myocardial infarction were elegantly confirmed by the improved calcium handling of the native cardiac myocytes in a rat model (73). Targeting the matrix to prevent cardiac dilation was proposed as an alternative to cellular replacement therapy; alginate injection could significantly reduce infarct expansion and improve function (74).

Several studies also examined the signaling pathways for cardiac hypertrophy as targets to prevent maladaptive remodeling. An interesting report described the protective effects of celecoxib, inhibiting Akt, on the development of heart failure after aortic banding (75). In the area of vascular biology, insights into the mechanisms of atherosclerosis have provided the basis for novel therapeutic approaches such as the testing of immunization against ox-low-density-lipoprotein. Novel potential strategies could include the up-regulation of "beneficial" immune cells. Gene therapy has long aimed for increased or novel protein expression, but gene silencing through interference with RNA translation has in recent years opened new approaches. CC-chemokine receptor 2 and monocyte chemoattractant protein-1 play a central role in monocyte recruitment to sites of inflammation. Local application of lentiviral short hairpin RNA against CC-chemokine receptor 2 could prevent vein graft thickening in vivo (76). In the area of "classic" pharmacology, HMR1766, a drug that activates the nitric-oxide-resistant oxidized soluble guanylate cyclase, could significantly reduce atherosclerotic plaque formation in the ApoE−/− mouse (77).

Identifying essential pathways promoting arteriogenesis could advance treatment of peripheral ischemic disease. Using a genetic print of a model for enhanced collateral flow, the actin-binding Rho activator was postulated to be a key regulator. Gene transfer in a hind-limb model of ischemia indeed enhanced arterial collateral perfusion by more than 70% (78).

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Reprint requests and correspondence: Dr. Jeroen J. Bax, Leiden University Medical Center, Albinusdreef 2, 2333 ZA Leiden, the Netherlands. E-mail: j.j.bax@lumc.nl.

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Telecardiology applied to a region-wide public emergency health-care service

Natale Daniele Brunetti · Gianfranco Amodio · Luisa De Gennaro · Giulia Dellegrottaglie · Pier Luigi Pellegrino · Matteo Di Biase · Gianfranco Antonelli

Abstract *Aim* To assess feasibility and reliability of telecardiology technologies applied to a region-wide public emergency health-care service. *Methods* About 27,841 patients from all over Apulia (19.362 km^2, 4 million inhabitants) were referred from October 2004 until April 2006 to public emergency health-care number "118" and underwent ECG evaluation according to a previously fixed inclusion protocol. Data recorded were transmitted with mobile telephone support to a telecardiology "hub" active 24-h a day. Hospitalization or further examinations were arranged by emergency physicians on the basis of ECG diagnosis and consultation. *Results* Thirty-nine percent of patients complained of chest pain (CP) or epigastric pain, 26% loss of consciousness, 10% breathlessness, and 7% palpitations. Atrial fibrillation (AF) was diagnosed in 11.68% of patients and ST-elevation acute myocardial infarction (STEMI) in 1.91%. Among patients with CP, ECG showed STEMI in only 3.84% of cases, theoretically eligible for fibrinolysis or primary PCI; patients with STEMI complained of CP in 78.94% of cases. Of the patients, 65.28% with STEMI were from small towns without coronary care units, thus benefiting from an immediate pre-hospital diagnosis. Among patients with palpitations, only 10.27% of subjects showed ECG signs of supra-ventricular tachycardia and 25.18% of AF; other subjects avoided further improper hospitalization or emergency department monitoring. *Conclusions* This first region-wide leading experience shows the feasibility and reliability of telecardiology applied to a public emergency health-care service. Telemedicine protocols would probably be useful in lowering the number of improper hospitalizations and shortening delay in the diagnosis process of some heart diseases.

Keywords Telecardiology · Emergencies · Public health care

N. D. Brunetti (✉) · L. De Gennaro · P. L. Pellegrino · M. Di Biase
Cardiology Department, University of Foggia, Foggia, Italy
e-mail: dr.natale.daniele.brunetti@hotmail.it

G. Amodio · G. Antonelli
U.O. Cardiologia D'Urgenza, Azienda Ospedaliera Policlinico, Bari, Italy

G. Dellegrottaglie
Cardio-on-line Europe S.r.l., Bari, Italy

Background

Emergency physicians have to face challenging difficulties in interpreting symptoms complained of by patients with suspected ischemic disease. Sensitivity and specificity of signs and symptoms might be very low, as reported by several case studies [1, 2]. Fewer data, moreover, are available with regards to new scenarios drafted by telecardiology technologies, nowadays involving a growing number of areas of medicine [3]. Cardiology could particularly benefit from telemedicine support, thanks to distance wireless data transmission of ECG. Telecardiology technologies have been increasingly applied in the recent past to small isolated community contexts needing distance monitoring for patients with chronic heart failure [4] or family practitioner activity [5, 6].

We report data from the first, the largest and the longest Italian region-wide experience of telecardiology applied to the public emergency health-care service; previous studies generally reported about early diagnosis of cardiac disease managed by general practitioners [6–8].

Methods

This study involved 27,841 patients from all over Apulia (19.362 km^2, 4 million inhabitants, Fig. 1), who were referred from October 2004 to April 2006 to the public emergency free health-care number "118." The number "118" is the Italian public free service for general medical or surgical emergencies, whose aim is an immediate diagnosis of critical diseases in order to avoid emergency room delay-to-diagnosis. Final hospitalization is arranged by teams of physicians and "118" district central, connected by mobile phone: direct admission to a critical care unit is arranged according to the level of care. Patients are discharged from the ambulance and not transported at all in case of normal findings.

Fig. 1 Apulia and its administrative districts

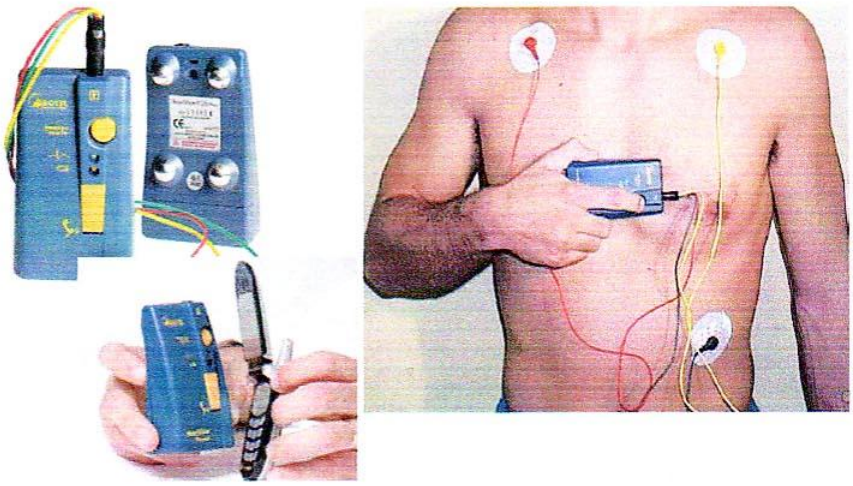
About 154 crews of the "118" emergency number were equipped in this study with special devices for recording and telephone transmission of 12-lead ECG: Cardio Vox P12 heart-line receiving system by Aerotel™ (Figs. 2 and 3). Logistic support was furnished by Cardio-on-line Europe S.r.l. thanks to a grant by Pfizer™. According to Italian legislation, "118" crews usually include a physician skilled in emergency medicine and nurses. The Cardio Vox device does not allow the "118" crew members to be shown the ECG record.

Data recorded by "118" physicians (emergency medicine specialists) were immediately transmitted by mobile phone to a "hub" center with a consultant cardiologist available 24-h a day, 365 days a year. About 20 cardiologists cooperated with Cardio-on-line Europe S.r.l., providing cardiologic consultancy. The hub center was furnished with 12 computer terminals, 25 telephone lines, 2 telephone operators 24-h a day, and emergency power in order to provide for a 24-h service even in case of black-out.

Indications for ECG recording were presence of chest pain or epigastric pain, breathlessness, palpitations, loss of consciousness, or anyway suspected acute cardiovascular disease. After ECG recording (<2 min), mobile telephone transmission (<2 min), and ECG diagnosis (few seconds), hospitalization in a coronary care unit or for primary coronary angioplasty was arranged by "118" district central when necessary. A physician-to-physician (emergency medicine—hub cardiologist) report about patient's history and physical examination immediately followed ECG transmission. Patients without either evidence of anomalies at ECG or clinical signs of increased risk for cardiovascular disease were not hospitalized. ECG data were archived on paper and CD ROM support.

ST segment elevation was considered as significant for myocardial infarction according to AHA/ACC/ESC criteria

Fig. 2 Cardiovox P12 and its application on patient's chest wall



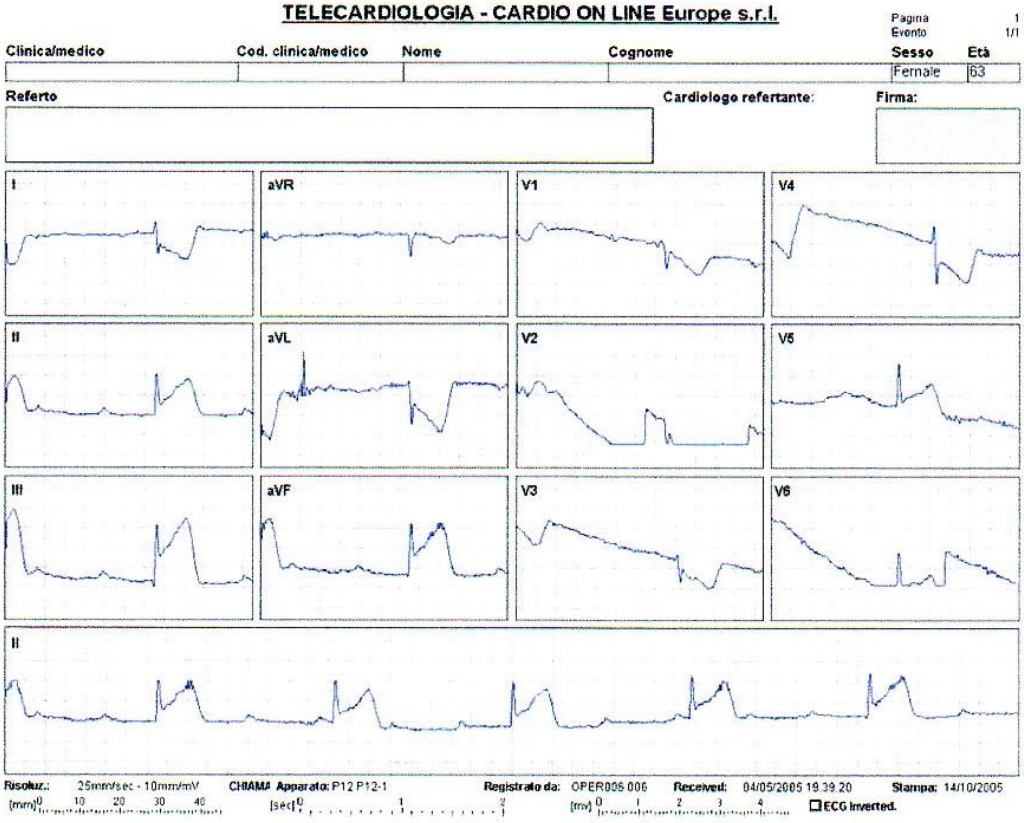


Fig. 3 Telecardiology ECG

published in 2000 (new or presumed new ECG alterations: ST segment elevation at the J point in two or more contiguous leads with the cut-off points ≥0.2 mV in leads V1, V2, or V3 and ≥0.1 mV in other leads) [9].

Results

The telecardiology call center received 27,841 calls from all over Apulia from October 2004 until April 2006: the trend drafted by calls month by month is reported in Fig. 4. After first 3 months of training, the hub-center received about 1,000 calls per month; peaks were observed in February–March and in August, probably coinciding with flu outbreaks and the summer tourist season. Of the patients who called "118" and underwent telecardiology evaluation, 50.76% were male, and mean age was 65 ± 19 years; 39% of patients complained of chest pain or epigastric pain, 26% loss of consciousness, 10% breathlessness, and 7% palpitations. Atrial fibrillation (AF) was diagnosed in 11.68% of patients, supra-ventricular tachycardia (SVT) in 1.61%, and ST elevation acute myocardial infarction (STEMI) in 1.91%. Peak in incidence of STEMI was observed in December, while AF was more commonly diagnosed in winter months. Seasonal incidence and trends by age of calls, STEMI, and AF are reported in Figs. 5–9.

Among patients with chest or epigastric pain, in 8.01% of cases ECG showed AF, in 0.98% SVT, and in 3.84% STEMI; among patients with breathlessness, in 22.16% of cases ECG showed AF, in 1.84% SVT, and in 0.93% STEMI; among patients with loss of consciousness, in 10.04% of cases ECG showed AF, in 0.85% SVT, and in 0.61% STEMI (Figs. 10 and 11). Sensitivity, specificity, and positive and negative predictive power of each symptom are reported in Table 1.

Patients with STEMI complained of chest pain in 78.94% of cases, breathlessness in 4.74%, palpitations in 0.57%, loss of consciousness in 8.36%, and other symptoms in 7.40%; 45% of subjects with STEMI were referred to "118" crews within 30 min after onset of chest pain, 41% between 30 min and 3 h, 4.86% between 3 and 6 h, 3.82% between 6 and 12 h, and 5% later than 12 h. Out of 11,000 patients with chest or epigastric pain, 3.84% ($n = 416$) of patients were theoretically eligible for

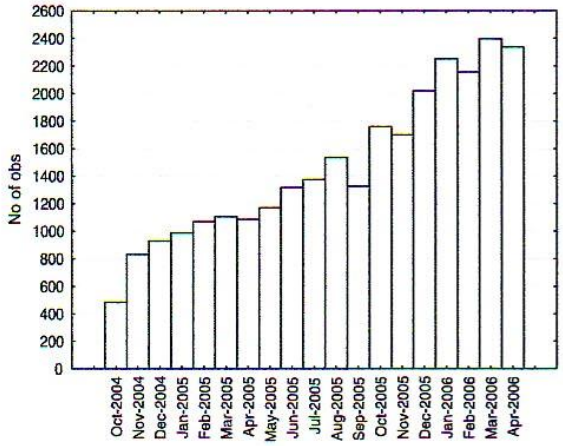


Fig. 4 Calls by month

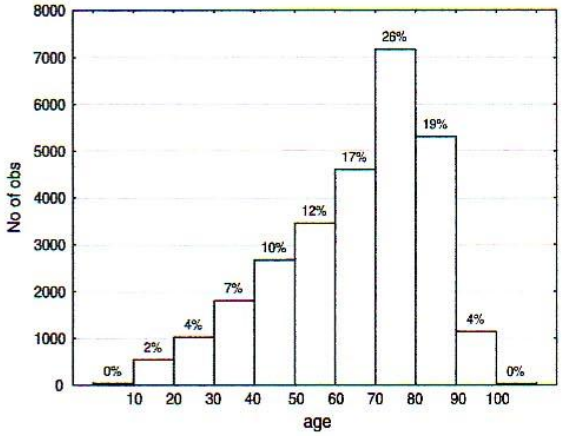


Fig. 7 Calls by age

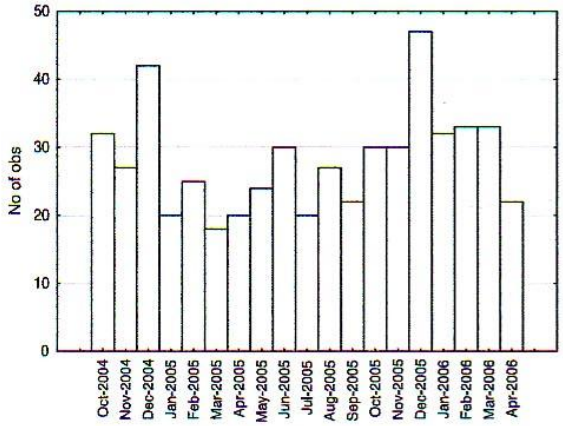


Fig. 5 ST elevation ACS by month

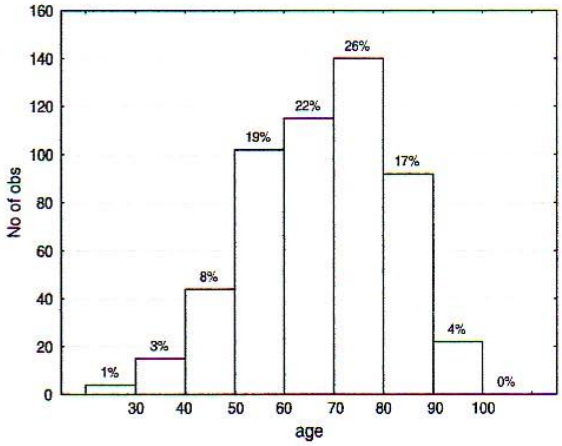


Fig. 8 ST elevation ACS by age

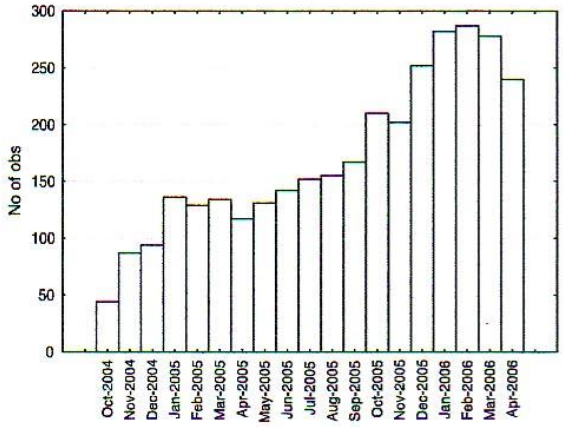


Fig. 6 Atrial fibrillation by month

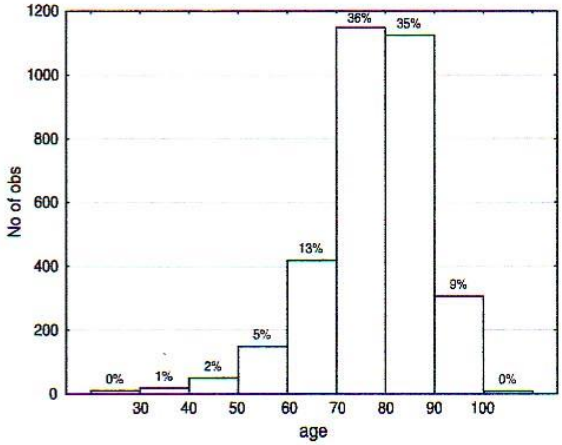
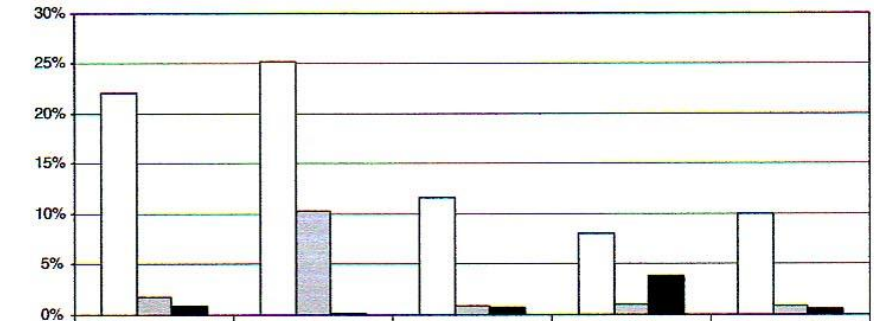


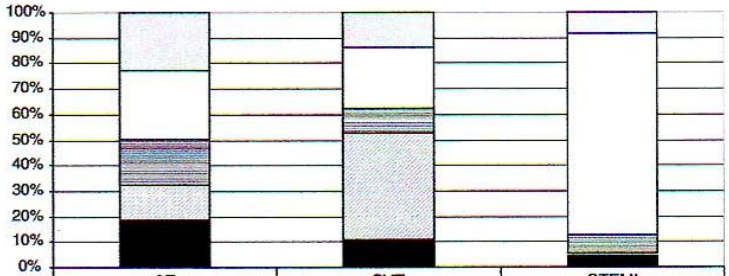
Fig. 9 Atrial fibrillation by age

Fig. 10 Symptoms and ECG diagnosis



	breathlessness	palpitations	other	chest pain	loss of consciousness
AF	22,16%	25,18%	11,58%	8,01%	10,04%
SVT	1,84%	10,27%	0,88%	0,98%	0,85%
STEMI	0,93%	0,17%	0,78%	3,84%	0,61%

Fig. 11 ECG diagnosis and symptoms



	AF	SVT	STEMI
loss of consciousness	22,56%	13,74%	8,35%
chest pain	26,99%	23,87%	78,94%
other	18,01%	9,91%	7,40%
palpitations	14,05%	41,44%	0,57%
breathlessness	18,39%	11,04%	4,74%

Table 1 Symptoms analysis

	Sens (%)	Spec (%)	Ppp (%)	Npp (%)	Acc (%)	
Palpitations	14.05	94.48	25.18	89.26	85.09	AF
Breathlessness	18.39	91.46	22.16	89.45	82.93	
Chest pain	26.99	59.00	8.01	85.94	55.26	
Loss of consciousness	22.56	73.26	10.04	87.74	67.34	
Other	18.01	81.81	11.58	88.30	74.36	
Palpitations	0.57	93.32	0.17	97.97	92.55	STEMI
Breathlessness	4.74	90.19	0.93	97.98	88.56	
Chest pain	78.94	61.43	3.84	99.34	61.77	
Loss of consciousness	8.35	73.41	0.61	97.62	72.17	
Other	7.40	81.64	0.78	97.84	80.22	
Palpitations	34.91	94.06	10.27	98.67	92.92	SVT
Breathlessness	9.30	90.33	1.84	98.08	88.78	
Chest pain	20.11	60.38	0.98	97.49	59.61	
Loss of consciousness	11.57	73.54	0.85	97.71	72.36	
Other	8.35	81.69	0.88	97.86	80.29	

Sensitivity (Sens), specificity (Spec), positive predictive power (Ppp), negative predictive power (Npp), and accuracy (Acc) of each symptom for ECG diagnosis (AF: atrial fibrillation, STEMI: ST elevation myocardial infarction, SVT: supra-ventricular tachycardia)

fibrinolysis or primary PCI. More than 47% of subjects with STEMI were older than 70 years. More than 60% of patients with STEMI received "118" assistance in towns without an immediately accessible coronary care unit (CCU), thus benefiting from an immediate diagnosis of STEMI. Among these patients from small towns, 47% called "118" within 30 min of onset of chest pain and 87% within 3 h, thus further benefiting from a very early diagnosis of STEMI; similar time delays were found in bigger towns with CCU (42% within 30 min, 84% within 3 h).

Among patients complaining of palpitations (about 2,000), only 10.27% of subjects showed ECG signs of SVT and 25.18% of AF; other subjects avoided further improper hospitalization or emergency department (ED) monitoring. Almost 80% of subjects with AF were older than 70 years.

Discussion

This first region-wide leading experience showed feasibility and reliability of telecardiology technology applied to a public emergency health service. A presumable lower number of improper hospitalizations and shorter delay in diagnosis process may be inferred applying telemedicine protocols also to large public emergency health-care networks.

The one we are reporting is the largest and the longest experience of telecardiology applied to a region-wide public emergency health-care network. Other experiences have been in even larger settings, as in the Georgia Statewide Academic and Medical System Network [10], which was however characterized by only 516 teleconsultations and fewer than 50 telecardiology consultations. Smaller although very interesting experiences have been held in Italy by Scalvini et al. [11], reporting lower incidence of rehospitalization in patients with heart failure, thanks to telecardiology support. The same authors reported data about telecardiology applied to settings of emergency cardiology [12] or family practitioner medicine [13].

Telecardiology met the expectations of a region-wide public emergency health-care service involving more than 4 million inhabitants. More than 21,000 ECGs submitted for telecardiology diagnosis in about 18 months of activity testify to the relevance attributed by physicians of the emergency number "118" to this diagnostic tool. Telecardiology examination is particularly useful in remote or isolated areas where qualified assistance of a cardiologist was not immediately available. A single hub-center network is essential for conciliating a high quality assistance with cost reducing, since, according to present Italian practice, cardiologist consultation is required for STEMI diagnosis, but a cardiologist cannot be included in all "118" crews.

Seasonal trends in the incidence of symptoms suggesting heart disease could be observed analyzing telecardiology databases; trends from our study are similar to those reported by other studies for incidence of heart disease or heart failure [14–17], albeit not all authors share these same conclusions [18]. A higher rate in incidence of heart disease has been reported by several authors in winter and fall. This has been explained by the influence of several factors such as flu epidemics during winter months.

Low numbers of abnormal ECG findings reported presumably documents a tendency of emergency physicians to overrate the risk of heart disease in patients complaining of symptoms such as chest pain or breathlessness. This behavior could be explained by the modern increasing risk of legal implications related to emergency diagnostic procedures [19]. On the other hand, this consistently elevated number of normal ECG findings corresponds to a lower number of patients needing further examinations or ED monitoring. A considerable number of patients complaining of symptoms suggesting heart disease would probably be sent for cardiologist examination or hospitalized if they had not been screened with telecardiology diagnostics. Overuse of telecardiology support by emergency physicians is however justified by the very low specificity of symptoms commonly related to heart disease. As reported by Pope et al. [20], the positive predictive power of a common symptom such as chest pain does not exceed 8%. Telecardiology support could dramatically reduce the number of false positives as reported in Table 1; more than 60% of subjects with palpitations might reasonably avoid further urgent examinations in ED or hospitalizations after ECG screening with telecardiology, since they are without any ECG evidence of arrhythmias. Telecardiology support could help in reducing diagnostic errors and improving quality of diagnosis. Probable reduction of improper hospitalization and ED monitoring could therefore provide a significant reduction of health-care costs.

Nowadays, the impact of telecardiology on health-care costs is not well determined: available data are still controversial since telecardiology has been reported by some authors as reducing costs of health-care assistance [21], while some others described increased costs [22]. For certain, telecardiology assistance improves the quality of health care [10] and, in a special way, of emergency health care.

Furthermore, telecardiology support could reduce delay to treatment of heart diseases. Delay in treatment has been reported as one of the principal outcome determinants in coronary heart disease, both in the case of primary PCI [23, 24] and in the case of fibrinolysis [25]. Nevertheless, remarkable delays in treatment have still been reported in several areas also of developed countries. In a paper by Nallamothu et al. [26], total door-to-balloon times for transfer patients undergoing primary PCI in the United

States rarely achieved guideline-recommended benchmarks. The authors concluded by suggesting that, for the full benefits of primary PCI to be realized in transfer patients, improved systems are urgently needed to minimize total door-to-balloon times. Terkelsen et al. [27] hence recently reported how telecardiology significantly lowered time to PCI in patients with STEMI. According to Ortolani et al., pre-hospital diagnosis is associated with a two-thirds reduction of in-hospital mortality in the case of STEMI complicated by cardiogenic shock [28]. Telecardiology technologies together with an effective network of tertiary care centers ready for primary PCI and adequately spread across the territory could thus suitably meet suggestions by Nallamothu et al. [26]. Data reported by these authors showed times to diagnosis for STEMI were rather higher if compared to those reported by our study: 53% of patients were admitted within 2 h after onset of chest pain and 74% within 6 h, while our data show how more than 40% of patients with chest pain and STE-ACS referred to "118" within 30 min after onset of symptoms and about 80% within 3 h. A consistent number of ischemic patients could thus benefit from telecardiology support since that could presumably reduce delay to treatment, in adherence with international society guidelines.

Study limitations

These are preliminary data needing confirmation in larger prospective and randomized trials. We actually presumed a reduction in improper hospitalization, costs, and delay to treatment since these patients diagnosed with STEMI or arrhythmias avoided ED triage. In a recent report by Solinas et al., the mean ED triage cost in Italy was 189 ± 237 euros per patient. Sixty-eight percent of patients needing ED triage were sent back home only 69 ± 60 min from admission and 32% required a brief clinical observation lasting 10 ± 6 h and including serial electrocardiographic and myocardial injury marker assessment [29].

Conflict of Interest Drs. Brunetti, De Gennaro, and Pellegrino cooperated with Cardio-on-line Europe as consultants.

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Telecardiologia a supporto del 118

Un'esperienza pugliese

E. Antoncecchi°, G. Antonelli*,
I. De Luca***, A. Passantino°, U. Rizzo°, G. Amodio*,
C. Parisi°, L. Mancini°, V. Antoncecchi°,
M. De Giosa**, L. Carella°°

°Cardio on Line Europe srl, Bari – Consiglio Direttivo ARCA Puglia
°°Centrale operativa 118, Taranto
**Cardiologia d'Urgenza, Ospedale Consorziale, Bari*
***Pronto Soccorso Ospedale Fallacara, Triggiano (Bari)*
****Divisione di Cardiologia, Ospedale Consorziale, Bari*

Abstract

Nell'ambito del progetto Leonardo nella Regione Puglia, il 118 si è avvalso di un centro di telecardiologia (Cardio on line Europe s.r.l.) che, al di fuori di strutture ospedaliere, ha ricevuto e interpretato in sei mesi 5962 ECG, fornendo a richiesta consulenza specialistica 24 ore al giorno. I medici soccorritori hanno svolto a loro discrezione tracciati ECG con una media giornaliera crescente (da 32,63 + 8,32 a 37,71 + 7,9). Nessuna differenza è stata riscontrata tra chiamate dai centri urbani e provincia. L'età media è stata 67,59 + 18,59 anni per le femmine e 62,80 + 18,29 anni per i maschi (51%). Il 41% degli ECG è stato eseguito per angor o equivalenti e in due terzi di essi l'esito è stato negativo. Sono stati riscontrati 166 IMA, di cui il 13% circa senza sintomi specifici. In un terzo circa dei casi, l'ECG era tale da consigliare il ricovero o l'invio a un Dipartimento di Emergenza. Nel 13,5% dei pazienti senza dolore è stato riscontrato un ECG compatibile con insufficienza coronarica. In conclusione, la telecardiologia ha mostrato una notevole utilità nel selezionare i pazienti da ricoverare, ridurre i costi e ottimizzare i tempi terapeutici nell'emergenza territoriale e costituisce un valido presupposto per l'attuazione della trombolisi extraospedaliera.

Parole chiave: Telecardiologia; 118; Emergenza; Elettrocardiogramma

The Apulian Emergency Service "118" is currently working in cooperation with the Telecardiology Centre called Cardio on line – srl for the "Leonardo Project". The centre operates in an outside-the-hospital setting. Over a period of six months they received and analysed 5962 ECGs, providing specialistic care on request 24 hours a day. Rescuer physicians performed ECGs at their own discretion with an increasing daily average (from 32,63 ± 8,32 to 37,71 ± 7). No differences were found in the ratio "incoming calls-inhabitants" between suburbs and urban centres. Females were 49% and males 51%. Mean age values ± SD were 67,59 ± 18,59 years for females and 62,80 ± 18,29 years for males. Forty-one percent of the ECGs was performed for angina and the like and in two thirds of them the outcome was negative. One hundred and sixty-six IMAs were detected, about 13% of which without specific symptoms. In about one third of the cases, according to the ECG either admission or referral to an Emergency Department was recommended. 13,5 percent of the patients without chest pain showed a CAD-compatible ECG. As a conclusion, telecardiology has shown relevant usefulness for the selection of patients needing hospital care, cost reduction and therapeutic timing optimisation in the territorial emergency. Telecardiology is also a solid premise for the implementation of prehospital thrombolysis.

Key words: Telecardiology; 118; Emergency; Electrocardiogram

INTRODUZIONE

La Puglia è stata tra le ultime regioni italiane ad avviare la rete di soccorso del 118; tuttavia, è la prima ad utilizzare in maniera sistematica e istituzionalizzata la telecardiologia a supporto della propria attività.[1-5] La particolare distribuzione sul territorio delle Unità di Cardiologia, e in particolare delle UTIC e dei centri di emodinamica interventistica, unitamente alla crescente domanda di assistenza per sindromi ischemiche acute fanno sì che diventi cruciale la selezione dei pazienti da inviare presso i centri specialistici per l'ottimizzazione delle risorse sanitarie. D'altro canto, la rivascolarizzazione miocardica precoce è la strategia più idonea per migliorare la prognosi dell'IMA a breve e a lungo termine.[6-9] Tutti gli studi sono concordi nel dimostrare i benefici della riperfusione precoce, sia che avvenga tramite trombolisi preospedaliera o intraospedaliera sia che avvenga tramite PTCA primaria.[10-12] Peraltro, quest'ultima sembra essere la più efficace se eseguita entro 90 + 30 minuti dall'ingresso in ospedale.[13-17] L'insieme delle motivazioni precedentemente esposte permette di valutare positivamente la possibilità da parte delle Unità di Soccorso del 118 di poter eseguire, quando lo ritengano utile, un esame elettrocardiografico completo nel luogo del soccorso e di inviarlo prontamente a un cardiologo che immediatamente lo referti e possa offrire un consulto telefonico. Peculiarità di questo Servizio di Telecardiologia è la sua ubicazione al di fuori dell'ospedale, in un centro privato distaccato da ogni struttura di emergenza pubblica o privata, con un call center dedicato e funzionante a tempo pieno in stretto contatto con le centrali operative provinciali del 118. Tale struttura, già esistente da alcuni anni sul territorio, è stata potenziata grazie a un progetto congiunto Regione Puglia-Pfizer, da quest'ultima finanziato, della durata complessiva di 18 mesi. Questo tipo di organizzazione supera la difficoltà di dover inserire un centro dedicato all'interno di strutture cardiologiche di emergenza che già sopportano ingenti carichi di lavoro, con organici di specialisti appena sufficienti, talvolta addirittura carenti, ottenendo di avere personale assolutamente concentrato e specializzato nel compito del teleconsulto.

MATERIALI E METODI

Il progetto

L'estensione, la popolazione e la suddivisione della rete 118 nella Regione Puglia sono riportate nella Tabella 1. A seguito di un accordo stipulato tra Regione Puglia e Pfizer, quest'ultima si è impegnata a finanziare una serie di progetti, tra cui uno dedicato all'emergenza sanitaria nell'ambito del cosiddetto Progetto Leonardo. Per la realizzazione di tale progetto sono stati utilizzati il know-how e la struttura già esistente della Società Cardio on Line Europe s.r.l., operante da alcuni anni sul territorio nel campo della telemedicina e in particolare della telecardiologia. Il progetto prevede il finanziamento per 18 mesi di una centrale di telerefertazione di ECG operante 24 ore su 24 in contatto telefonico con tutte le postazioni del 118 del territorio regionale e con le centrali operative provinciali dello stesso 118 e l'acquisto degli apparecchi per l'acquisizione e la trasmissione degli ECG.

Strumentazioni, percorso e personale

Tutte le postazioni sono state dotate di un apparecchio P12 della Aerotel validato dalla FDA per la trasmissione telefonica di un ECG a 12 derivazioni. Tutto il personale delle postazioni (1800 tra medici, infermieri e volontari) è stato precedentemente istruito con corsi di formazione, della durata complessiva di 600 ore, all'acquisizione e all'invio dei tracciati ECGrafici. La centrale di telecardiologia si avvale della presenza costante di cardiologi e operatori telefonici che, 24 ore su 24, rispondono alle chiamate provenienti dalle postazioni. La postazione, dopo aver registrato l'ECG, comunica il proprio codice, i dati anagrafici del paziente, le motivazioni dell'esecuzione dell'ECG, i sintomi accusati dal paziente e la durata del dolore toracico. La trasmissione avviene avvicinando il P12 a un telefono fisso o portatile di qualsiasi tipo e viene completata in circa 50 secondi. L'operatore di CoL dà il benestare all'invio del tracciato e un'interfaccia permette al segnale sonoro di passare dal ricevitore telefonico al computer; il software dedicato della Aerotel (HRS) decodifica il segnale e lo divide nelle 12 derivazioni standard più una derivazione DII più lunga per l'analisi del ritmo. Le sei derivazioni periferiche, la V1 e la V2 sono registrate simultaneamente, le altre precordiali in 2 tempi successivi. Acquisito il tracciato su computer, il cardiologo della CoL scambia le proprie osservazioni con il medico della postazione del 118, raccogliendo altre notizie cliniche, e riferisce verbalmente l'esito della refertazione. Immediatamente il tracciato ECG viene stampato con il nome e la firma del cardiologo e inviato via fax alla centrale operativa di referenza del 118; contemporaneamente, il cardiologo riferisce al medico di centrale il referto ed eventuali altre notizie, affinché la centrale operativa possa disporre per l'eventuale ricovero, scegliendo e allertando la struttura ospedaliera di accoglienza più adeguata.

Motivo e modalità delle chiamate

I motivi dell'invio dei tracciati ECG sono stati precedentemente concordati e sono elencati nella Tabella 2; tuttavia, anche in situazioni differenti, su decisione del medico dell'ambulanza, è possibile che venga effettuato un ECG.

È possibile che cattive registrazioni per problemi inerenti le condizioni del paziente o le condizioni di trasmissione (telefonia mobile con campi insufficienti o con interferenze elettromagnetiche, trasmissioni dall'autoambulanza in corsa) possano non permettere l'arrivo di un tracciato completamente leggibile. In tal caso, l'operatore invita i soccorritori a registrare o a trasmettere nuovamente il tracciato finché non sia possibile un'adeguata registrazione. In alcuni casi, allorché il medico soccorritore reputi l'esecuzione dell'ECG non indispensabile oppure giudichi prioritario il precoce arrivo del paziente in Pronto Soccorso, può decidere di soprassedere alla ripetizione: in tal caso, il cardiologo trasmette in centrale operativa 118 quanto ha ricevuto, quale ne sia la qualità.

Tutti i tracciati con i riferimenti di data, postazione di trasmissione, dati paziente, referto firmato e nome e firma del refertatore sono conservati nel database della CoL.

Periodo di osservazione

Nel presente lavoro sono stati analizzati tutti i dati relativi alle chiamate dei primi sei mesi di attività (11 ottobre 2004-10 aprile 2005).

Diagnosi ECG

La diagnosi ECG di IMA è possibile se è evidente la classica onda di lesione con sopraslivellamento >1 mm in 2 derivazioni consecutive (>2 mm in V1-V3) e con immagine a specchio nelle derivazioni opposte (STEMI); tale quadro viene a essere fortemente validato dalla presenza di sintomi tipici dell'insufficienza coronarica acuta. Tuttavia, la distanza dall'ammalato, la conoscenza parziale della situazione clinica, la non conoscenza del know-how e del modus operandi del gruppo di soccorritori invita alla prudenza e a essere più larghi nel consigliare il trasporto verso l'ospedale più vicino. Gli aspetti presi in considerazione per la diagnosi certa o dubbia di IMA sono: S-T sopraslivellato >1 mm in 2 derivazioni consecutive (>2 mm in V1-V3) e con immagine a specchio; stessi aspetti, ma senza immagine a specchio; tratto S-T lievemente sopraslivellato (<2 mm) in almeno 2 derivazioni consecutive, senza immagine a specchio e con sintomi riferibili a insufficienza coronarica; BBS di nuova insorgenza o, se sconosciuto, l'aspetto ECG precedente e QRS indotto da pacemaker associati a sintomi anginosi o equivalenti.[18]

Le alterazioni di tipo ischemico del tratto S-T (S-T sottoslivellato ad andamento orizzontale o discendente) o T negative, aguzze simmetriche e difasiche, nuove o presumibilmente nuove, sono state comunque indicate come meritevoli di approfondimento diagnostico, soprattutto se associate a sintomi di possibile origine ischemica di cui è mostrata la prevalenza in Tabella 2 (linee guida dell'ACC/AHA 2002).[19,20] Il resto delle anomalie ECG è stato refertato secondo i canoni consueti e consolidati della metodica.

RISULTATI

Nella Tabella 1 sono riportati i dati relativi all'arrivo delle chiamate. Il totale delle chiamate in 6 mesi è stato di 5962, con la seguente divisione per provincia: Lecce 2122 (36%), Bari 1439 (24%), Taranto 1435 (24%), Foggia 680 (11%), Brindisi 286 (5%). L'impatto sulle chiamate dei 5 centri capoluogo di provincia in cui è concentrato il maggior numero di centri ospedalieri è stato del 21,87%. La media giornaliera mensile delle chiamate è aumentata di mese in mese (da 32,63 + 8,32 a 37,71 + 7,9) (Fig. 1).

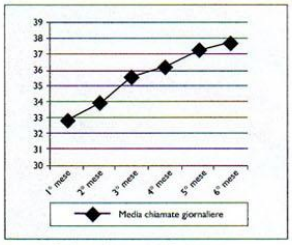

Figura 1. *Media giornaliera mensile delle chiamate*

Tabella 1. *I dati di popolazione sono riferiti all'ultimo censimento del 2001. Il numero delle chiamate è riferito all'intero periodo di 6 mesi*

	Puglia	Bari	Brindisi	Foggia	Lecce	Taranto
Abitanti	4.090.068	1.569.133	414.906	697.638	818.033	590.358
Comuni	258	48	20	64	97	29
Centrali 118	5	1	1	1	1	1
Postazioni 118	145	48	14	31	26	26
N. chiamate	5962	1439	286	680	2122	1435
Chiamate/postazione	41,12	29,98	20,43	21,94	81,62	55,19
Chiamate/1000 abitanti	1,46	0,91	0,69	0,97	2,59	2,43
Abitanti nei capoluoghi (% popolazione provinciale)	893.672 (22%)	333.550 (21%)	94.429 (23%)	155.785 (22%)	99.372 (12%)	210.536 (36%)
% chiamate nei capoluoghi rispetto all'intera provincia	21,87	18,07	23,78	6,47	7,92	32,75

Esami ripetuti ed esami parzialmente non leggibili

Il 15% circa di esami è stato registrato o trasmesso più di una volta, mentre il 3,57% non era assolutamente leggibile e i soccorritori hanno preferito desistere. Di tutti gli esami trasmessi e refertati, il 23,02% presentava una derivazione o 2 non consecutive non perfettamente valutabili, ma non tali da impedirne un'attendibile formulazione diagnostica.

Motivazione delle chiamate

Nella Tabella 2 sono riportati i sintomi che hanno indotto all'esecuzione dell'ECG con la loro prevalenza. I sintomi definiti come altro includono controllo in cardiopatici, constatazione di decesso, nausea, vomito, astenia, malessere generale, stato d'ansia, panico e sudorazione.

È evidente che un gran numero di esami svolti (il 41%) viene effettuato per escludere un'insufficienza coronarica.

Tabella 2. *Prevalenza dei sintomi che hanno indotto all'esecuzione dell'ECG e motivazioni per le quali è stata consigliata l'esecuzione*

ECG eseguiti		
Motivo	**Numero**	**Prevalenza (%)**
Dolore o equivalenti	2458	41
Sincopi	1201	20
Cardiopalmo	350	6
Dispnea	564	9
Disturbi dello stato di coscienza	79	1
Crisi ipertensive	171	3
Shock o ipotensione	64	1
Altro	760	13
Non riportati	315	6

Distribuzione per età e sesso dei pazienti

La distribuzione per sessi con età media e DS dell'età è stata: femmine (67,59 + 18,59 anni): 2912 ECG eseguiti; maschi (62,80 + 18,29 anni): 3050 ECG eseguiti. Nella Figura 2 è mostrata la distribuzione per fasce di età: si può notare la massima prevalenza nel gruppo 70-79 anni, mentre il 60,59% delle chiamate riguarda persone di età compresa tra 61 e 90 anni.

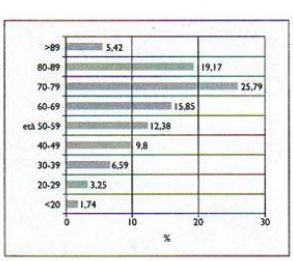

Figura 2. *Distribuzione percentuale delle chiamate per decadi di età*

Diagnosi ECG

Sono state effettuate 2458 registrazioni ECG (41,22% del totale) per sintomi di presunta angina pectoris o equivalenti (dolore toracico con le diverse irradiazioni, epigastralgia, oppressione toracica). Tra queste, in 795 casi (32,37%) l'ECG presentava un'alterazione compatibile con un'origine ischemica del dolore. La tipologia delle alterazioni e il relativo numero di casi sono riportati nella Tabella 3. Ben 30 sopraslivellamenti di S-T compatibili con diagnosi di IMA su 166 (22%) non erano accompagnati da sintomi specifici e 328 pazienti dei 3506 (13,18%) senza angor o equivalenti presentavano alterazioni ECG correlabili a insufficienza coronarica. In totale, i pazienti sintomatici e non che avevano un ECG sicuramente o molto probabilmente correlabile a insufficienza coronarica acuta erano 1123 su 5962 (18,83%), compresi quelli con BBS associato ad angor o equivalenti.

Nella Tabella 4 sono invece riportati i confronti tra sintomatologia e aritmie raggruppate in ipocinetiche e ipercinetiche. Le aritmie minacciose o rilevanti ai fini dell'urgenza erano 854 (14,32% di tutti gli ECG), di

Tabella 3. *Numero di ECG con alterazioni verosimilmente correlate a IMA o ischemia in rapporto a sintomi specifici*

Aspetti ECG	Pazienti con dolore toracico o equivalenti (2458)		Pazienti senza dolore toracico o equivalenti (3504)	
Sopraslivellamento S-T >2 mm con immagine a specchio	82	136**	21	38**
Sopraslivellamento S-T >2 mm senza immagine a specchio	54		17	
Sopraslivellamento S-T <2 mm	104	196*	60*	
BBS	92		128*	
Sottoslivellamento S-T orizzontale o discendente >1 mm	81**	463	57*	
Sottoslivellamento S-T orizzontale o discendente <1 mm	177*		143	326*
T negative di probabile origine ischemica	205**		183	
Assenza di alterazioni ECG di tipo ischemico		1663		2895

**Molto probabilmente correlabili a IMA o ischemia acuta.
*Probabilmente correlabili a IMA o ischemia acuta.
*Alterazioni da valutare (ma verosimilmente non correlate al motivo della chiamata).

Tabella 4. *Aritmie ipo- e ipercinetiche e sintomi associati*

Sintomi	A. ipercinetiche	A. ipocinetiche
Non riportati	23	3
Cardiopalmo	123 (16%)	1 (1,5%)
Ipotensione, lipotimie o disturbi dello stato di coscienza	142 (19%)	31 (44%)
Angor o equivalenti	240 (31%)	15 (21,5%)
Dispnea	137 (19%)	7 (10%)
Altro	111 (15%)	16 (23%)

cui 781 ipercinetiche (BPV ripetitivi, FA ad alta o normale FVM, flutter atriale, tachicardie a QRS largo, TPS, PM con alterazione del sensing) e 73 ipocinetiche (arresto sinusale, BAV di 2° grado tipo 2, BAV avanzato, BAV di 3° grado, mancato stimolo o cattura del PM, ritmo idioventricolare, FA a bassa FVM). Si evidenzia chiaramente come il sintomo prevalente nelle forme ipercinetiche sia l'angor o i suoi equivalenti (31%), mentre nelle forme ipocinetiche lo è il gruppo di ipotensione, lipotimie o alterazioni della coscienza (44%).

In 174 casi, la diagnosi di ischemia era associata a quella di aritmie ipercinetiche e in 7 ad aritmie ipocinetiche. Le diagnosi ECG che secondo la definizione della Tabella 3 sono probabilmente o molto probabilmente correlate a un'insufficienza coronarica acuta sono 950 e quelle con aritmie gravi 854, escludendo i casi di sovrapposizione; i casi con alta probabilità di patologia grave sono 1618, ai quali devono aggiungersi 392 pazienti (al netto delle sovrapposizioni con aritmie) il cui ECG presentava anomalie borderline o verosimilmente non acute della ripolarizzazione, che vanno comunque valutati con visita specialistica. In tal modo, il numero totale di pazienti che devono essere valutati con visita specialistica è di 2015 (33,79%).

Gli ECG normali o con anomalie sicuramente non inerenti all'acuzie sono stati 3947 (66,21%).

In 1663 dei 2458 pazienti con dolore o equivalenti (67,66%) si è potuta escludere un'alterazione ECG.

DISCUSSIONE

L'esperienza del Progetto Leonardo presenta senza dubbio alcune novità: (a) la partnership tra fondazione privata ed ente pubblico nella costituzione di una rete dell'emergenza all'avanguardia tra le esperienze sia nazionali sia internazionali; (b) l'impiego istituzionalizzato di risorse di telecardiologia su una popolazione e un ambito territoriale molto ampi a supporto del servizio di emergenza del 118; (c) l'impiego nell'ambito dell'emergenza al fianco delle strutture pubbliche di una centrale e un pool di operatori slegati dall'ospedale e operanti dal territorio. Il primo aspetto compete a un ambito politico-economico che non interessa la nostra trattazione e i cui risultati e implicazioni positive o negative saranno valutati in altra sede. Per quanto concerne il secondo aspetto, sicuramente non si tratta della prima esperienza di telecardiologia nel settore dell'emergenza;[21-25] tuttavia, sembra essere la prima a livello internazionale con un compito istituzionalmente definito a supporto dell'intero sistema di emergenza di riferimento (il 118) della Regione Puglia, con una rete a diffusione capillare in un territorio ampio e popolato da oltre 4 milioni di abitanti. Per quanto concerne il luogo di espletamento di tale attività, è ovviamente marginale dal punto di vista logistico dove fisicamente essa avvenga poiché il vantaggio della telecardiologia è proprio che l'informazione possa raggiungere il medico ovunque: è invece importante che un'attività delicata per le conseguenze decisionali e con ricadute sull'attività ospedaliera avvenga al di fuori dello stesso contesto ospedaliero. Questo, peraltro, consente che il personale medico e paramedico impegnato non possa essere distratto da problematiche inerenti pazienti gravi, presenti sul posto, che, come sappiamo, all'occorrenza assorbono ogni energia disponibile; che gli eventuali consigli di raggiungere o meno l'ospedale non siano influenzati, sia pure inconsapevolmente, da problemi quali la necessità di incrementare o ridurre ricoveri o procedure; che non venga aggravata la carenza di personale quasi ovunque appena sufficiente per la gestione delle ordinarie attività di reparto.

Dal punto di vista dei risultati dei primi sei mesi di attività, dobbiamo sottolineare come la crescente richiesta giornaliera di esami ECG dimostri una crescente fiducia nel sistema e l'apprezzamento di un'utilità effettiva del servizio (Fig. 1). L'utilizzo dell'ECG a distanza pare notevolmente diverso nelle varie province, come si evidenzia nella Tabella 1, raggiungendo un rapporto di circa 3,5:1 nel confronto tra chiamate per numero di abitanti di zone con massimo e minimo utilizzo (Lecce/Brindisi). L'interpretazione di tali differenze è difficile: la maggiore estensione e quindi distanza dai centri specialistici di alcuni territori (Lecce) giustifica un atteggiamento di maggiore attenzione nel decidere su un possibile trasporto; pare tuttavia probabile che in alcune zone vi sia un atteggiamento restrittivo all'esecuzione di esami ECG. A questo proposito, si è cercato di diffondere linee guida che consigliano il medico soccorritore su quando eseguire il tracciato. In realtà, come descritto nella Tabella 2, la maggior parte dei casi aveva una valida motivazione cardiologica coerente con le linee concordate. Tuttavia, il 13% dei casi includeva situazioni apparentemente non correlate a un sintomo di pertinenza cardiologica: il diverso bagaglio culturale del medico o di tutta l'équipe, la presenza di circostanze non strettamente cliniche (quali ingerenza di parenti o conoscenti oppure la distanza dai centri ospedalieri) poteva essere motivo valido per l'esecuzione di un ECG. Talvolta la motivazione era la constatazione di un decesso o l'anamnesi positiva per cardiopatia.

La distribuzione percentuale delle chiamate nelle fasce di età prevalente in quelle alte (61% tra i 60 e 90 anni) non sorprende, considerando l'alta prevalenza di malattie cardiovascolari nelle età avanzate e la minore capacità di trasporto degli anziani con propri mezzi nei centri di soccorso.

La diagnosi ECGrafica a distanza è ovviamente la parte chiave e anche la più delicata della presente esperienza. È evidente che, nonostante precise linee guida diagnostiche, il medico si trova talora, dopo avere eseguito un ECG, nell'indecisione di proseguire o meno nell'iter diagnostico od osservazionale. Con il presente sistema di telecardiologia, in cui l'osservazione del malato non è personale, ma mediata da un collega non specialista e in cui, in alcuni casi, la traccia ECG può non essere perfetta, l'imbarazzo e la possibilità di errori sono ancora maggiori. Per tale motivo, il cardiologo refertatore è motivato a un atteggiamento di prudenza, cioè a una maggiore descrittività più che interpretazione diagnostica del tracciato e a una maggiore propensione nel considerare le interpretazioni più infauste. Se tale aspetto da un lato evidenzia un limite del sistema, dall'altro non ne inficia l'utilità: in assenza di un servizio telecardiologico, tutti i casi dubbi verrebbero comunque trasportati in PS. D'altra parte, tale sistema ha un'elevata affidabilità[3] e in molti casi la diagnosi ECG è certa e precoce, orientando verso la corretta terapia, verso l'ospedale più idoneo e abbreviando i tempi di attesa nei Pronto Soccorso o nei Dipartimenti di Emergenza a vantaggio dell'inizio della terapia di riperfusione, oggi ancora molto tardiva nell'esperienza italiana.[26] Le incertezze diagnostiche riguardano quasi sempre la diagnosi di cardiopatia ischemica, laddove non sempre la negatività del tracciato offre garanzia di assenza di patologia e in cui diventa cruciale anche la valutazione del sintomo e del rischio globale del paziente.[27] La valutazione delle aritmie è invece nella quasi totalità dei casi certa.

Un limite importante del presente lavoro è il non poter avere un riscontro della diagnosi finale e dell'esito di tali eventi: la raccolta di questi dati richiederebbe un coordinamento di moltissime postazioni 118, Pronto Soccorso e Divisioni di Medicina, Cardiologia e Cardiochirurgia di tutto il territorio regionale. Stiamo tuttavia cercando di superare il problema. I criteri diagnostici applicati per la diagnosi di IMA o di sopraslivellamento S-T (S-T >2 mm in almeno 2 derivazioni consecutive), al di sopra dei valori consigliati dalle linee guida per la diagnosi dello STEMI,[28] forniscono un basso rischio di falsi positivi e possiamo pertanto ritenere attendibili i casi da noi definiti come molto probabili (136 con e 30 senza sintomi specifici). La frequenza media di tali eventi è di circa una volta al giorno, insieme ad altri 1,5 episodi di "probabile" IMA e 3 di ischemia (S-T sottoslivellato o T negative). Non vi sono invece dubbi nelle diagnosi di aritmie clinicamente rilevanti e che necessitano di ricovero (circa 7 al giorno), tra le quali alcune, avendo a disposizione una diagnosi ECG, possono ricevere un trattamento immediato sul posto da proseguire poi in ospedale. Quindi, in almeno 12,5 pazienti al giorno si può consigliare correttamente il ricovero e in alcuni di essi guadagnare tempo prezioso per la prognosi quoad vitam o quoad valetudinem. D'altra parte, in circa 1663 casi (2/3 circa) di dolore toracico o equivalenti si poteva dimostrare un ECG negativo riducendo perdite di tempo e impegno di mezzi di soccorso e affluenza nei centri di Pronto Soccorso. In definitiva, ogni giorno in 11 pazienti su 33 (33%) si può fare diagnosi certa di un evento cardiaco acuto ed in 9 (28%) si può dimostrare un ECG negativo nonostante la presenza di sintomi di presunta ischemia, in 2 (6,5%) si evidenzia un tracciato patologico, ma non necessariamente riferibile a un'emergenza, in 1 (3%) il tracciato non è valutabile e nei restanti 10 casi (29,5%) si conferma l'assenza di patologia ECGrafica in pazienti con sintomi non specifici. Pertanto, l'ECG si dimostra risolutivo nel 69% dei casi e solo nel 28% dei pazienti, quelli con positività dei sintomi e negatività dell'ECG, i dati clinico-anamnestici devono essere prevalenti nella decisione del medico soccorritore circa l'ospedalizzazione. In alcuni frangenti (p.es., pazienti con dolore che dura da diverse ore), il disporre di kit rapidi per l'esecuzione di dosaggi enzimatici consentirebbe una diagnosi più specifica. Considerando che, complessivamente, i tempi di diagnosi di ECG ed enzimi non supererebbero i 10-15 minuti, mentre i tempi di attesa nei Dipartimenti di Emergenza possono essere molto più lunghi, e che spesso il paziente è a notevole distanza dall'ospedale, la diagnosi telecardiologica appare estremamente conveniente. Inoltre, tale sistema potrebbe essere di supporto all'eventuale attuazione della trombolisi preospedaliera dimostratasi vantaggiosa in altre esperienze.[28-31]

CONCLUSIONI

L'utilizzo dell'ECG trasmesso dalle postazioni del 118 a una centrale di telecardiologia, in 6 mesi di esperienza su tutto il territorio della Regione Puglia, si è dimostrato una metodica utile che viene sempre più adoperata dagli operatori. L'uso del servizio non è omogeneo su tutto il territorio e non mostra differenze significative tra grandi centri urbani e provincia. L'analisi di 5962 ECG ricevuti in 6 mesi ha permesso di riconoscere nel 33% di essi un evento cardiaco acuto e di escluderlo nel 36%. Pertanto, è stato utile dal punto di vista diagnostico nel 69% dei casi, ha evitato ricoveri impropri nel 37% e ha ridotto i tempi di accesso nelle vere emergenze.

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17. ACC/AHA Guidelines for Primary Percutaneous Coronary Intervention for Patients with Acute Trasmural Myocardial Infarction as an Alternative to Thrombolysis

Università degli studi di Foggia

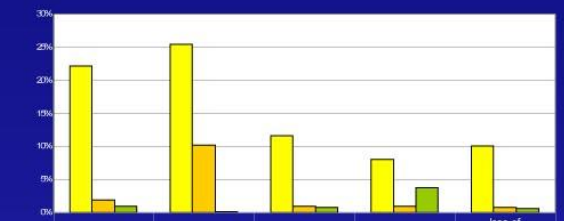
Azienda Ospedaliera Policlinico Bari

Sensibilità e specificità dei sintomi in soggetti con sospetto infarto miocardico acuto o aritmia: analisi dei dati di una esperienza regionale di telecardiologia applicata al servizio regionale 118

ND Brunetti (a), G Amodio (b), L De Gennaro (a), G Dellegrottaglie (c), PL Pellegrino (a), M Di Biase (a), G Antonelli (b)

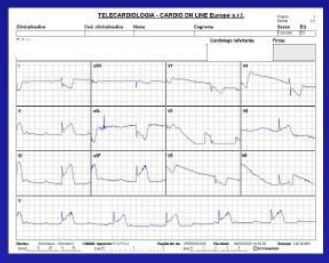
(a) U.O. Cardiologia Universitaria, Ospedali Riuniti, Foggia, (b) Cardiologia d'Urgenza, Azienda Ospedaliera Policlinico, Bari, (c) Cardio-On-Line Europe Srl, Bari

BACKGROUND La diagnosi d'urgenza in soggetti con sospetto infarto miocardico o aritmia cardiaca può risultare estremamente insidiosa per il medico del 118. La sensibilità e la specificità di segni e sintomi come il dolore toracico o il cardiopalmo risultano poi poco studiati, specie alla luce dei contributi che le moderne metodiche di telecardiologia possono offrire. Gli oltre 160 equipaggi del 118 e punti di primo soccorso della regione Puglia sono stati dotati di apparecchi CardioVox P12 per la registrazione e la trasmissione tramite telefono di un ECG a 12 derivazioni. Il supporto logistico è stato fornito dalla Cardio-On-Line Europe S.r.l. grazie ad un grant della Pfizer ™.



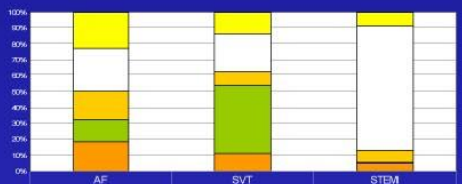
	breathlessness	palpitations	other	chest pain	loss of consciousness
AF	22,16%	25,18%	11,58%	8,01%	10,04%
SVT	1,84%	10,27%	0,88%	0,98%	0,85%
STEMI	0,93%	0,17%	0,78%	3,84%	0,61%

METODI 27841 pazienti da tutta la regione Puglia che avevano fatto ricorso ai servizi del 118 regionale sono stati sottoposti ad ECG d'urgenza dall'ottobre del 2004 ad aprile del 2006 in base a protocolli fissati dalle centrali provinciali di coordinamento del servizio 118. Le registrazioni sono state immediatamente trasmesse alla centrale regionale di telecardiologia dove un cardiologo ha refertato in tempo reale il tracciato, comunicando il referto al collega del 118 e trasmettendo via fax il tracciato alla centrale provinciale di coordinamento.



Centrale di telecardiologia
Tracciato ecg trasmesso in telecardiologia

Patologia – sintomi ⇓ sintomi – patologia ⇑



	AF	SVT	STEMI
loss of consciousness	22,56%	13,74%	8,35%
chest pain	26,99%	23,87%	78,94%
other	18,01%	9,91%	7,40%
palpitations	14,05%	41,44%	0,57%
breathlessness	18,39%	11,04%	4,74%

	sens	spec	ppp	ppn	acc	
palpitations	14,05%	94,48%	25,18%	89,26%	85,09%	AF
breathlessness	18,39%	91,46%	22,16%	89,45%	82,93%	
chest pain	26,99%	59,00%	8,01%	85,94%	55,26%	
loss of consciousness	22,56%	73,26%	10,04%	87,74%	67,34%	
other	18,01%	81,81%	11,58%	88,30%	74,36%	
palpitations	0,57%	93,32%	0,17%	97,97%	92,55%	STEMI
breathlessness	4,74%	90,19%	0,93%	97,98%	88,56%	
chest pain	78,94%	61,43%	3,84%	99,34%	61,77%	
loss of consciousness	8,35%	73,41%	0,61%	97,62%	72,17%	
other	7,40%	81,64%	0,78%	97,64%	80,22%	
palpitations	34,91%	94,06%	10,27%	98,67%	92,92%	SVT
breathlessness	9,30%	90,33%	1,84%	98,08%	88,78%	
chest pain	20,11%	60,38%	0,98%	97,49%	59,61%	
loss of consciousness	11,57%	73,54%	0,85%	97,71%	72,36%	
other	8,35%	81,69%	0,88%	97,86%	80,29%	

Analisi delle sensibilità dei sintomi

RISULTATI Il 39% riferiva dolore toracico o epigastrico, il 26% disturbi dello stato di coscienza, il 10% dispnea il 7% palpitazioni. L'11.68% dei soggetti mostrava all'ECG fibrillazione atriale (FA), l'1.62% TPS, l'1.91% STEMI. Degli oltre 10.000 soggetti con dolore toracico sospetto per IMA, solo il 3.84% dei soggetti mostrava segni ECG di STEMI, mentre dei 1792 soggetti con riferito cardiopalmo solo il 10.97% mostrava una TPS. Tra i pazienti con dispnea, nel 22.16% dei casi l'ECG mostrava FA, nell'1.84% TPS, nello 0.93% STEMI, tra quelli con cardiopalmo, nel 25.18% FA, nel 10.27% TPS, nello 0.17% STEMI, tra quelli con dolore toracico o epigastrico, nello 8.01% FA, nello 0.98% TPS, nel 3.84% STEMI, tra quelli con disturbo dello stato di coscienza, nel 10.04% FA, nello 0.85% TPS, nello 0.61% STEMI. Sensibilità, specificità, potere predittivo ed accuratezza di ciascun sintomo sono riportati in tabella.

CONCLUSIONI I sintomi riferiti da pazienti con sospetto IMA o aritmia sono estremamente poco sensibili ed aspecifici. Le metodiche di telecardiologia possono risultare utili nel ridurre gli errori diagnostici in condizioni di urgenza e nel migliorare la qualità del servizio. Questa prima esperienza di applicazione estensiva delle metodiche di telecardiologia ad un servizio regionale di 118 mostra l'affidabilità e la realizzabilità di tale collaborazione.

La telecardiologia per la diagnosi di infarto miocardico acuto nell'anziano

Natale Daniele Brunetti (a), Gianfranco Amodio (b), Luisa De Gennaro (a), Giulia Dellegrottaglie (c), Pier Luigi Pellegrino (a), Matteo Di Biase (a), Gianfranco Antonelli (b)

(a) U.O. Cardiologia Universitaria, Ospedali Riuniti, Foggia, (b) Cardiologia d'Urgenza, Azienda Ospedaliera Policlinico, Bari, (c) Cardio-on-line Europe S.r.l, Bari

SCOPO dello STUDIO L'infarto miocardico acuto (IMA) nell'anziano può spesso esordire con una presentazione clinica atipica, caratterizzata da sintomi diversi dal dolore toracico anginoso. Una corretta ed immediata diagnosi può risultare pertanto complicata, con conseguenze potenzialmente drammatiche sia in termini di sopravvivenza che di maggiore incidenza di eventi avversi.
MATERIALI e METODI 27841 pazienti rivoltisi al 118 della regione Puglia (4 milioni di abitanti) sono stati sottoposti a valutazione ecg con metodiche di telecardiologia. I dati registrati sono stati trasmessi mediante telefonino ad una centrale di telecardiologia attiva 24 ore su 24. L'eventuale ospedalizzazione è stata disposta in base al referto ecg ed alla consulenza fornita dal cardiologo operante presso la centrale di telecardiologia.
RISULTATI Il 39% dei pazienti sottoposti ad ecg hanno riferito dolore toracico od epigastrico, il 26% disturbi dello stato di coscienza, il 10% dispnea, il 7% cardiopalmo. L'IMA con sopraslivellamento del tratto ST (STEMI) è stato diagnosticato nell'1,92% dei casi considerati: nel 65,54% si trattava di pazienti sesso maschile, nel 47,44% di pazienti di età superiore ai 70 anni e tra questi ultimi, il 49,60% era di sesso maschile. L'età media dei pazienti con STEMI differiva tra i due sessi: 64,64±13,82 per il sesso maschile e 74,76±12,82 per il sesso femminile ($p<0,001$), con una distribuzione bimodale tra i due sessi. Tra i pazienti con STEMI di età inferiore a 70 anni il dolore toracico e/o epigastrico era presente nell'88,81% mentre una sintomatologia atipica (dispnea, perdita di coscienza, cardiopalmo ed altri sintomi) nell'11,19% dei casi (10,81% per il sesso maschile vs 12,73% per il sesso femminile, p n.s.). I pazienti anziani (>70 anni) mostravano invece una presentazione atipica di STEMI nel 32% dei casi (34,92% per il sesso femminile vs 29,03% per il sesso maschile, p n.s.) ($p<0,001$ rispetto ai pazienti giovani). La frequenza di presentazione atipica e misconosciuta di STEMI aumenta dal 9,17% nei pazienti di età compresa tra 60-69 anni, al 25,56% nella fascia d'età tra 70-79 anni, al 35,24% tra gli 80-89 anni ed al 46,15% nella fascia d'età superiore ad 89 anni ($p<0,01$ in tutti i casi); l'esecuzione di un ecg con metodiche di telecardiologia ha consentito di ridurre in modo significativo gli errori ed i ritardi nella formulazione della diagnosi.
CONCLUSIONI La telecardiologia può costituire un valido ausilio nella riduzione degli errori e dei ritardi nella diagnosi di STEMI nella popolazione anziana, caratterizzata da una maggior prevalenza di presentazione clinica atipica.

4518 : Acute myocardial infarction home diagnosis in a region wide telecardiology network for public emergency health care service: an experience from Italy

Authors:
Brunetti (Foggia /Italy), **Amodio** (Bari /Italy), **Dellegrottaglie** (Bari /Italy), **De Gennaro** (Bari /Italy), **Pellegrino** (Bari /Italy), **Di Biase** (Bari /Italy), **Antonelli** (Foggia /Italy)

Topic(s):
Internet and Telemedicine

Citation:
European Heart Journal (2007) 28 (Abstract Supplement), 788

Aim: To assess feasibility and reliability of telecardiology technologies applied to a region-wide public emergency health care service.

Methods: 27841 patients from all over Apulia (19.362 Km^2, 4 millions inhabitants), referred since October 2004 until April 2006 to public emergency health care number "118" and underwent ECG evaluation according to a previously fixed inclusion protocol. Data recorded were transmitted with a mobile telephone support to a telecardiology "hub" active 24-hours a day. Hospitalization or further examinations were disposed by emergency physicians on basis of ECG diagnosis and consultation.

Results: 39% of patients referred chest pain (CP) or epigastric pain, 26% loss of consciousness, 10% breathlessness, 7% palpitations. Atrial fibrillation (AF) was diagnosed in 11.68% of patients, STEMI in 1.91%. Among patients with CP, ECG showed STEMI in only 3.84% of cases, theoretically eligible for fibrinolysis or primary PCI; patients with STEMI referred CP in 78.94% of cases. Among patients with palpitations, only 10.27% of subjects showed ECG signs of supra-ventricular tachycardia, 25.18% of AF; other subjects avoided further improper hospitalization.

Conclusions: This first region wide leading experience shows feasibility and reliability of telecardiology applied to a public emergency health care service. Lower number of improper hospitalizations and shorter delay in diagnosis point out benefits yieldable applying telemedicine protocols also to large public emergency health care networks.

e-POSER SESSION
Sunday, 3 September 2006

Eur Heart J (2006) 27
(Abstract Supplement), p. 140

e-POSTER SESSION 1

P878 **Acute myocardial infarction home diagnosis in a region wide telecardiology network for public emergency health care service: an experience from Italy**

N.D. Brunetti[1], G. Dellegrottaglie[2], L. De Gennaro[1], G. Amodio[3], M. Di Biase[3], G.F. Antonelli[1]. *[1]University of Foggia, Cardiology Department, Foggia, Italy; [2]Cardio on Line Europe S.r.l., Bari, Italy; [3]Azienda Ospedaliera Policlinico, Bari, Italy*

Background We report data coming out from the first, the largest and the longest Italian region wide experience of telecardiology applied to public emergency health care. The network involved 154 crews of "118" emergency number that were equipped with CardioVox-P12 devices for 12 leads ECG recording and telephone transmission. Logistic support was furnished by Cardio-on-line Europe S.r.l. thanks to a grant by Pfizer™.
Methods 15475 patients from all over Apulia (19.362 Km^2, 4 millions inhabitants) referred since October 2004 until November 2005 to "118" and underwent ECG according to a previously fixed inclusion protocol. Data recorded were transmitted with mobile telephone to a call-center with a consultant cardiologist. Hospitalization or further cardiologic examination were disposed by emergency physicians on basis of ECG diagnosis and consultation.
Results Mean age was 65±18 years; 73% of patients referred chest or epigastric pain, 10% loss of consciousness, 4% breathlessness, 3% palpitations. Acute myocardial infarction (AMI) was diagnosed in 2.2%. Peak in incidence of AMI was observed in autumn. Among patients with chest or epigastric pain, in 2.4% of cases ECG showed STEMI; patients with AMI referred chest pain in 76.5% of cases, breathlessness in 5.2%, palpitations in 1.16%, loss of consciousness in 7%, other symptoms in 5.2%. 5% of subjects referred to "118" <30 minutes after onset of symptoms, 35% between 30 m' and 3 hours, 52% 3-6 hours, 1% 6-12 hours, 6% >12 hours; out of 11.000 patients with chest or epigastric pain, thus 1.48% of patients was theoretically eligible for fibrinolysis or primary PCI. In this subset of patients telecardiology diagnosis consistently shortened delay to treatment. More than 35% of subjects with STEMI was more than 75 years old. 49.8% received "118" assistance in towns without coronary care unit (CCU); 46% of patients with STEMI was from small towns without CCU, thus benefiting from immediate-diagnosis. Among these patients from small towns, 47% called "118" within 30 m' after onset of chest pain, 38% within 3 hours, thus further benefiting from a very early diagnosis of STEMI because of time to reach CCU or cathlab; similar time delay was recorded in bigger towns with CCU (43.3%+41.7%).
Conclusions: This first region wide leading experience showed feasibility and reliability of telecardiology applied to a public emergency health care. Lower number of improper hospitalizations and shorter delay in diagnosis process point out advantages yieldable applying telemedicine protocols also to large public emergency health care networks.

P643 : Telecardiology for acute myocardial infarction diagnosis in the elderly

Authors:
Brunetti (Foggia /Italy), Amodio (Bari /Italy), Dellegrottaglie (Bari /Italy), De Gennaro (Bari /Italy), Pellegrino (Bari /Italy), Di Biase (Bari /Italy), Antonelli (Foggia /Italy)

Topic(s):
cardiovascular diseases and aging

Citation:
European Heart Journal (2007) 28 (Abstract Supplement), 90

Aim acute: myocardial infarction in elderly patients might show an atypical presentation, with symptoms other than chest or epigastric pain. A timely and correct diagnosis might thus be neglected or delayed with dramatic clinical and survival consequences in this setting of patients characterized by a higher incidence of adverse events.

Methods: 27841 patients from all over Apulia (19.362 Km^2, 4 millions inhabitants), referred since October 2004 until April 2006 to public emergency health care number "118" and underwent ECG evaluation. Data recorded were transmitted with a mobile telephone support to a telecardiology "hub" active 24-hours a day. Hospitalization or further examinations were disposed by emergency physicians on basis of ECG diagnosis and consultation.

Results: 39% of patients referred chest or epigastric pain, 26% loss of consciousness, 10% breathlessness, 7% palpitations. ST elevation acute myocardial infarction (STEMI) was diagnosed in 1.92% of patients enrolled. 65.54% of patients with STEMI were male, 47.44% were older than 70 years, 49.60% of patient older than 70 years were male. Mean age of male patients with STEMI was 64.64±13.82 vs 74.76±12.82 for females ($p<0.001$), with a bimodal distribution for two genders. Among patients with STEMI <70 years old chest or epigastric pain was present in 88.81% of subjects while atypical presentation (breathlessness, loss of consciousness, palpitations, other symptoms) was detected in remaining 11.19% (10.81% for males vs 12.73% for females, p n.s.). Elderly patients (>70 years old) showed atypical presentation of STEMI in 32% of cases (34.92% for females vs 29.03% for males, p n.s.) ($p<0.001$ in comparison to younger patients). Rate of atypical misleading presentation of STEMI rose up from a 9.17% in the class of age 60-69 years to 25.56% in the class 70-79, to 35.24% in the class 80-89, and to 46.15% in the class >89 ($p<0.01$ in all cases); dramatic errors or delay of diagnosis were thus avoided thanks to an immediate home ECG in a significant number of patients.

Conclusions: Telecardiology home ECG diagnosis could significantly help in avoiding errors and delay of STEMI diagnosis in elderly patients with an increased prevalence of atypical presentations.

P3979 : Clinical utility of telecardiology in the pre-hospital evaluation of chest pain patients

Authors:
Amodio (Bari /Italy), Martinelli (Bari /Italy), Brunetti (Foggia /Italy), Germinario (Bari /Italy), Antonelli (Bari /Italy)

Topic(s):
Acute cardiac care, other

Citation:
European Heart Journal (2007) 28 (Abstract Supplement), 659

Purpose: to assess the utility of telecardiology in the pre-hospital evaluation of patients with suspected Acute Coronary Syndromes (ACS).

Method: 7176 patients from Apulia (Italy) referring from 1st January to 31st December 2005 to regional Emergency Medical System "118" (EMS) for chest or epigastric pain were studied (time interval from the call to the EMS intervention was ≤ 20 minutes). After anamnesis and clinical examination performed by the emergency physician, all patients underwent (in the ambulance or at home) ECG 12 leads recording; data recorded were transmitted with a mobile telephone for report to a call-centre with a consultant cardiologist active 24 hours a day; after telephonic consultation with the cardiologist, clinical decisions were disposed by the emergency physician on the basis of ECG result and clinical data. Pre-hospital suspected diagnoses made with telecardiology system were compared to final diagnoses obtained at the end of hospital admission and reported in the Regional Medical Hospital Registry.

Results: 389 (5.4%) patients had an ACS; telecardiology identified 54.4% of patients with ACS (212 patients) and 84.2% of patients without ACS (5720 patients). Statistical data from our study are reported in table 1.

Conclusions: telecardiology is useful in the pre-hospital evaluation of suspected ACS, allowing a very early correct diagnostic assessment in a great number of patients. However, telecardiology can't substitute in-hospital evaluation in the diagnostic management of patients with suspected ACS.

Table I}

Sensibility (95% C.I.)	**54 (50-59)**
Specificity (95% C.I.)	84 (83-85)
Positive predictive value (95% C.I.)	17 (15-19)
Negative predictive value (95% C.I.)	97 (97-97)
Likelihood ratio+	0.19
Likelihood ratio-	0.53
True positive	212
False positive	1067
True negative	5720
False Negative	177

telecardiologia a disposizione del servizio pubblico regionale di emergenze mediche (118): update dei dati della regione Puglia

Natale Daniele Brunetti (a), Gianfranco Amodio (b), Giulia Dellegrottaglie (c), Luisa De Gennaro (a), Pier Luigi Pellegrino (a), Matteo Di Biase (a), Gianfranco Antonelli (b)

(a) U.O: Cardiologia Universitaria, Ospedali Riuniti, Foggia, (b) Cardiologia d'Urgenza, Azienda Ospedaliera Policlinico, Bari, (c) Cardio-on-line Europe S.r.l, Bari

SCOPO dello STUDIO Valutare la possibilità di realizzare un servizio di telecardiologia a disposizione del servizio 118.
MATERIALI e METODI 27841 pazienti rivoltosi al 118 della regione Puglia (4 milioni di abitanti) sono stati sottoposti a valutazione ecg con metodiche di telecardiologia secondo un protocollo prestabilito. I dati registrati sono stati trasmessi mediante telefonino ad una centrale di telecardiologia attiva 24 ore su 24. L'ospedalizzazione o ulteriori accertamenti diagnostici sono stati disposti dai medici del 118 in base al referto ecg ed alla consulenza fornita dal cardiologo operante presso la centrale di telecardiologia.
RISULTATI Il 39% dei pazienti riferiva dolore toracico od epigastrico, il 26% disturbi dello stato di coscienza, il 10% dispnea, il 7% cardiopalmo. La fibrillazione atriale è stata diagnosticata nell'11,68% dei pazienti, segni ecg di STEMI nell'1,91%. Solo il 3,84% dei pazienti sintomatici per dolore toracico presentava segni ecg di STEMI (risultando pertanto in teoria eligibile di fibrinolitici o di angioplastica primaria); i pazienti con STEMI riferivano dolore toracico nel 78,94% dei casi. Tra i pazienti sintomatici per palpitazioni, solo nel 10,27% l'ECG evidenziava aritmie sopraventricolari e nel 25,18% fibrillazione atriale; nei restanti casi sono state evitate ospedalizzazioni inappropriate.
CONCLUSIONI L'esperienza di telecardiologia realizzata in collaborazione con il servizio 118 della regione Puglia dimostra le numerose potenzialità di tali metodiche di telecardiologia, con notevoli ricadute in termini di riduzione delle ospedalizzazioni inappropriate e dei ritardi di trattamento adeguato.

TELECARDIOLOGIA e 118 NELLA REGIONE PUGLIA

Il "Progetto Leonardo"

Gianfranco Antonelli

CARDIOLOGIA D'URGENZA

Azienda Ospedaliero-Universitaria
Consorziale Policlinico - Bari

CONCLUSIONI

- **La Telecardiologia nel sistema di Emergenza 118 si è dimostrata un valido mezzo per la diagnosi precoce e il corretto indirizzo terapeutico.**
- **Il Sistema viene considerato nella Regione Puglia il fulcro per la imminente attivazione della Rete della Emergenze per le Angioplastiche Primarie e la Trombolisi pre-Ospedaliera.**

Università degli studi di Foggia
Cattedra di Cardiologia

Azienda Ospedaliera
Policlinico Bari
Cardiologia d'Urgenza

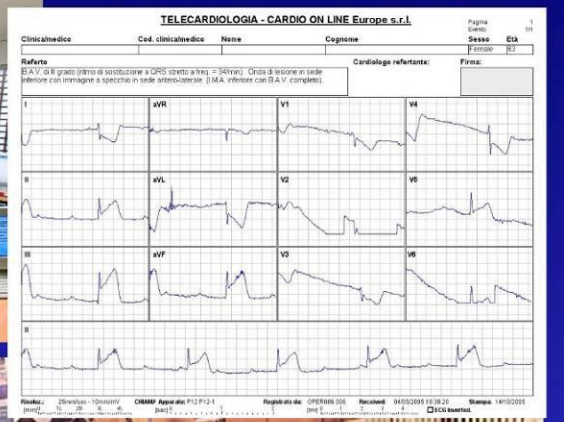
Telecardiologia applicata al servizio 118 della regione Puglia: 18 mesi e 27.000 pazienti

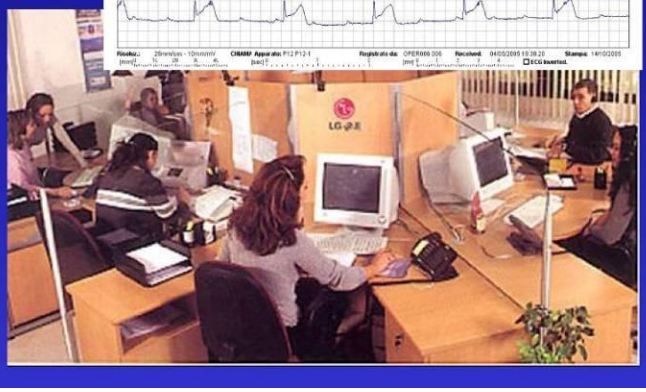
ND Brunetti, G Amodio, L De Gennaro, G Dellegrottaglie, PL Pellegrino, M Di Biase, G Antonelli

Roma, 19 dicembre 2006

Telecardiologia Puglia: Cardio-On-Line Europe ®

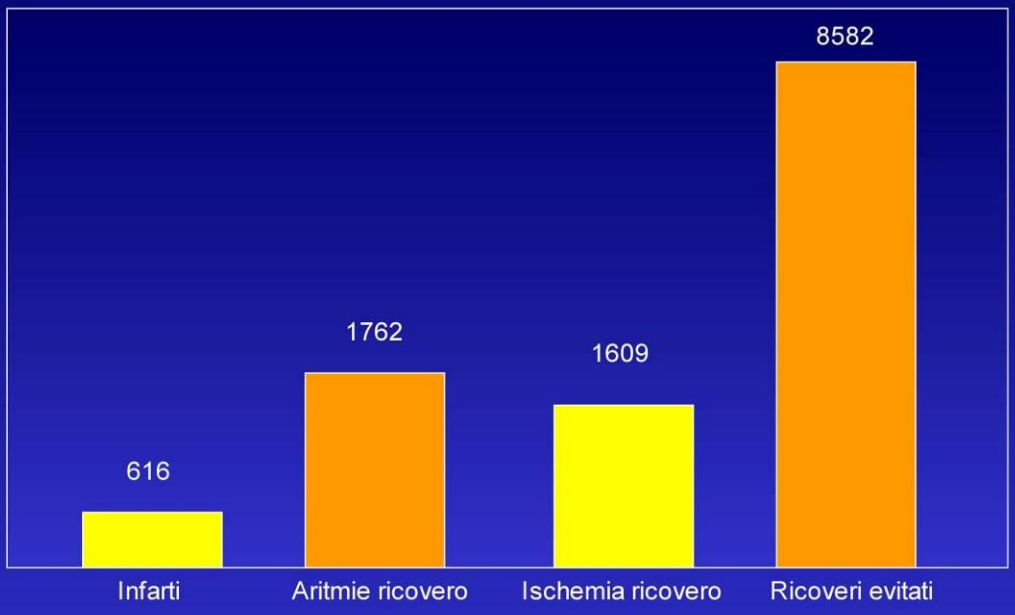
Centrale telecardiologia





Centrale 118

Regione Puglia: 118 e Telecardiologia



Risparmio annuo: 4 milioni euro

Regione Puglia: 17/9/2005

Conclusioni

- l'applicazione di metodiche di telecardiologia a setting di cardiologia d'urgenza e alla realtà del 118 è utile ed affidabile
  - riduce gli errori diagnostici
  - riduce i ricoveri non necessari
  - riduce il time to treatment nei pazienti con STEMI

Objectives

We report data coming out from the first, the largest and the longest Italian region wide experience of telecardiology applied to public emergency health care. The network involved 154 crews of "118" emergency number that were equipped with CardioVox-P12 devices for 12 leads ECG recording and telephone transmission. Logistic support was furnished by Cardio-on-line Europe S.r.l. thanks to a grant by Pfizer™.

Methods & Materials

15475 patients from all over Apulia (19.362 Km², 4 millions inhabitants) referred since October 2004 until November 2005 to "118" and underwent ECG according to a previously fixed inclusion protocol. Data recorded were transmitted with mobile telephone to a call-center with a consultant cardiologist. Hospitalization or further cardiologic examination were disposed by emergency physicians on basis of ECG diagnosis and consultation.

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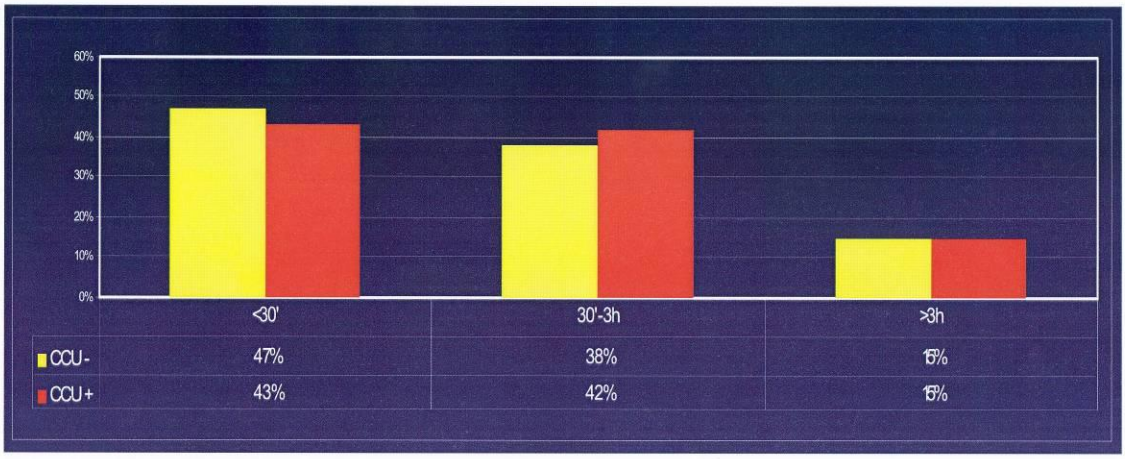
Results



Rates of patients per classes of time to diagnosis: cities with coronary care unit (CCU) vs. towns without CCU

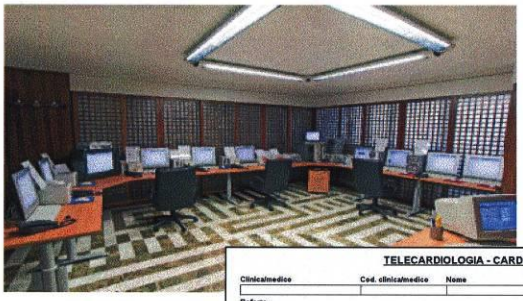
Results

Mean age was 65±18 years; 73% of patients referred chest or epigastric pain, 10% loss of consciousness, 4% breathlessness, 3% palpitations. Acute myocardial infarction (AMI) was diagnosed in 2.2%. Peak in incidence of AMI was observed in autumn.

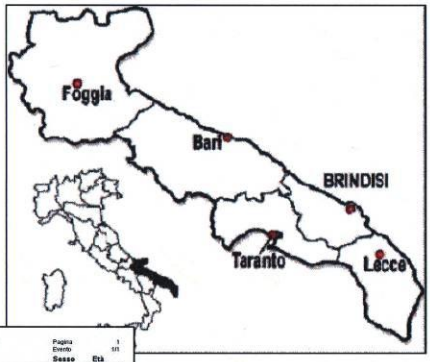
Among patients with chest or epigastric pain, in 2.4% of cases ECG showed STEMI; patients with AMI referred chest pain in 76.5% of cases, breathlessness in 5.2%, palpitations in 1.16%, loss of consciousness in 7%, other symptoms in 5.2%. 5% of subjects referred to "118" <30 minutes after onset of symptoms, 35% between 30 m' and 3 hours, 52% 3-6 hours, 1% 6-12 hours, 6% >12 hours; out of 11.000 patients with chest or epigastric pain, thus 1.48% of patients was theoretically eligible for fibrinolysis or primary PCI. In this subset of patients telecardiology diagnosis consistently shortened delay to treatment. More than 35% of subjects with STEMI was more than 75 years old.

49.8% received "118" assistance in towns without coronary care unit (CCU); 46% of patients with STEMI was from small towns without CCU, thus benefiting from immediate diagnosis. Among these patients from small towns, 47% called "118" within 30 m' after onset of chest pain, 38% within 3 hours, thus further benefiting from a very early diagnosis of STEMI because of time to reach CCU or cathlab; similar time delay was recorded in bigger towns with CCU (43.3%+41.7%).

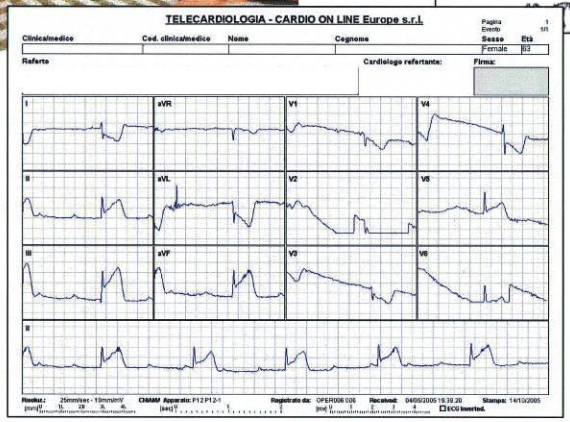
Illustrations & Figures



Telecardiology call-centre



Italy: Apulia



An ECG sent by telephone: inferior wall acute myocadial infarction

Conclusions

This first region wide leading experience showed feasibility and reliability of telecardiology applied to a public emergency health care. Lower number of improper hospitalizations and shorter delay in diagnosis process point out advantages yieldable applying telemedicine protocols also to large public emergency health care networks.

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Via Salvatore Matarrese 2/O - 70124 Bari - Tel 0805613578 - Fax 0805610336
Cap. Soc. € 100.000,00 - P. IVA n. 04871010726 - C.C.I.A.A. Bari n. 290463/96
pec: *cardioonlineeurope@pec.it* - e mail: *info@cardioonlineeurope.com*
web *www.cardioonlineeurope.com*

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