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Original research

Long-term survival benefit of ramipril in patients with acute myocardial infarction complicated by heart failure

Jianhua Wu ,^{1,2} Alistair S Hall,³ Chris P Gale,⁴ on behalf of the AIREX Study Investigators

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¹School of Dentistry, University of Leeds, Leeds, UK

²Leeds Institute for Data Analytics, University of Leeds, Leeds, UK

³Medicine, Leeds Institute for Genetics Health and Therapeutics, Leeds, UK
⁴Leeds Institute for Cardiovascular and Metabolic Medicine, University of Leeds, Leeds, UK

Correspondence to: Professor Alistair S Hall, Medicine, Leeds Institute for Genetics Health and Therapeutics, Leeds LS1 3EX, UK; a.s.hall@leeds.ac.uk

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ABSTRACT

Aims ACE inhibition reduces mortality and morbidity in patients with heart failure after acute myocardial infarction (AMI). However, there are limited randomised data about the long-term survival benefits of ACE inhibition in this population.

Methods In 1993, the Acute Infarction Ramipril Efficacy (AIRE) study randomly allocated patients with AMI and clinical heart failure to ramipril or placebo. The duration of masked trial therapy in the UK cohort (603 patients, mean age=64.7 years, 455 male patients) was 12.4 and 13.4 months for ramipril (n=302) and placebo (n=301), respectively. We estimated life expectancy and extensions of life (difference in median survival times) according to duration of follow-up (range 0–29.6 years).

Results By 9 April 2019, death from all causes occurred in 266 (88.4%) patients in placebo arm and 275 (91.1%) patients in ramipril arm. The extension of life between ramipril and placebo groups was 14.5 months (95% CI 13.2 to 15.8). Ramipril increased life expectancy more for patients with than without diabetes (life expectancy difference 32.1 vs 5.0 months), previous AMI (20.1 vs 4.9 months), previous heart failure (19.5 vs 4.9 months), hypertension (16.6 vs 8.3 months), angina (16.2 vs 5.0 months) and age >65 years (11.3 vs 5.7 months). Given potential treatment switching, the true absolute treatment effect could be underestimated by 28%.

Conclusion For patients with clinically defined heart failure following AMI, ramipril results in a sustained survival benefit, and is associated with an extension of life of up to 14.5 months for, on average, 13 months treatment duration.

INTRODUCTION

Survival following acute myocardial infarction (AMI) remains a key objective for healthcare professionals and governments throughout the globe. Despite major advances in the emergency treatment and secondary prevention of AMI, a substantial proportion of patients with AMI develop heart failure,¹ which in turn is associated with high morbidity, mortality and healthcare expenditure.^{2–4}

Moreover, therapeutic inhibition of ACE has become an established strategy in the care of patients with AMI and heart failure.⁵ ACE inhibition reduces death and disease in patients with left ventricular systolic dysfunction, and coronary artery disease.^{6–8} In the Acute Infarction Ramipril

Efficacy (AIRE) study, ACE inhibition at an average follow-up time of 15 months after randomisation significantly reduced all-cause mortality, and continued to confer a survival benefit at 3 years following study closure in the AIRE Extension (AIREX) study.^{9–12} Further placebo-controlled survival studies testing the efficacy of ACE inhibition in patients with AMI and clinical heart failure are unlikely because withholding a treatment of accepted clinical value would be unethical. Therefore, in the AIRE survival (AIRE-S) study, we aimed to assess the long-term (29.6 years after randomisation) magnitude of impact on length of survival observed after treatment with ramipril (target dose 5 mg twice daily) when compared with placebo.

METHODS

Patients and design

The rationale, design, organisation, outcome definitions and results of the AIRE study have been published previously.^{10–12} This was an independent, multinational, multicentre, double-blind, randomised, placebo-controlled, parallel-group investigation into the potential benefits from treatment with the lipophilic ACE inhibitor ramipril (target dose 10 mg/day) following AMI complicated by clinical evidence of heart failure. When the trial was conducted, in 1993, all patients had an ECG and cardiac enzyme confirmation of AMI, and also evidence of transient or persisting heart failure as judged by the attending physician (chest X-ray evidence of left ventricular failure, or auscultatory evidence of pulmonary oedema, or a third heart sound in the presence of persistent tachycardia), usually sufficient to justify diuretic or vasodilator therapy. Patients were excluded if they had evidence of clinical instability, contraindications to the use of ACE inhibitor therapy, heart failure of primary valvular or congenital origin or overt heart failure deemed to require treatment with an open-label ACE inhibitor. After applying these entry criteria to consecutive patients admitted to the UK centres (30 centres), 44% of patients approached declined to give their consent to take part in the study. All 603 of the remaining patients were then randomised by telephone to receive masked treatment with either ramipril (titrated over 4 days to 5 mg twice daily) or a matching placebo. Treatment was started between 2 and 9 days after the onset of AMI. Patients initially received either 1.25 or 2.5 mg ramipril or

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Coronary Care Manual Peter L. Thompson,2010-12-03 The Coronary Care Manual has been designed as a practical manual for the management of the acute coronary patient and aims to achieve a balance between the large and rapidly changing evidence base and practical application in the CCU ICU ED and ambulance The book has been written by a group of Australian and international experts for medical nursing and paramedic staff working in these areas This edition covers a broad range of coronary care medicine in enough detail to eliminate the need to refer to a larger reference book providing a portable companion for a night on call Completely redesigned with new artwork the manual is organized to suit academics and practitioners alike covers a broad range of coronary care medicine provides specific advice on the management of common clinical problems eliminates the need to refer to a larger reference book features a consistent style and focus with standardised artwork for figures is now also available as an eBook A code inside the Coronary Care Manual enables a full text download allowing you to browse and search electronically make notes and bookmarks in the electronic files and highlight material

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Geriatric Medicine Christine K. Cassel, Rosanne Leipzig, Harvey Jay Cohen, Eric B. Larson, Diane E. Meier, 2006-05-29

Since the publication of the third edition of *Geriatric Medicine* extraordinary advances have occurred in the science of aging and the potential for biomedical research to give us answers to many if not most of the age related disorders that threaten the quality of life in older years At the most basic level the successful mapping of the human genome was declared complete in the fall of 2000 Understanding the map of the human genome is as important as understanding the map of genomes of important laboratory species ranging from the microscopic worms and fruit flies used in most classic genetic studies to rodents such as laboratory mice and eventually to primates on which much of the research on the aging human brain is done The genetic maps of all of these species including our own does not answer clinical questions but it does open the door to dramatic rapid and efficient answers to questions about the genetic polymorphisms related to diseases in humans The telomerase story also unfolded since the third edition Telomerase is an enzyme responsible for maintaining the telomeres the redundant DNA portions at the end of chromosomes whose shortening seems to be linked directly to cell senescence apoptosis and the control over cell death which at the level of the individual cell seems to be linked to the decline of organ function and eventually aging and death within the organism *Reichel's Care of the Elderly* Christine Arenson, Jan

Busby-Whitehead, Kenneth Brummel-Smith, James G. O'Brien, Mary H. Palmer, William Reichel, 2009-02-09 The sixth edition remains the pioneering text for the practising physician confronted with the unique problems of an increasingly elderly population Dr William Reichel's formative text is designed as a practical and useful guide for health specialists from medical students to practicing physicians This book is not a collection of subspecialty chapters but rather emphasizes the clinical management of the geriatric patient with simple to complex problems The editors have reviewed every chapter and have included the most up to date advances in the care of the elderly New chapters include hormonal therapy in post menopausal women drug therapy for Alzheimer's sufferers alternative medicine the chronic understaffing of nursing homes management of delirium and ethical issues Comprehensive and written for any clinicians caring for older patients including family physicians general internists nurse practitioners geriatricians and other specialists this esteemed text provides practical and trusted advice **Hemostasis and Thrombosis** Victor J. Marder, William C. Aird, Joel S. Bennett, Sam Schulman, Gilbert C.

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Critical Pathways in Cardiovascular Medicine Christopher P. Cannon, Patrick T. O'Gara, 2007 Full text medical e book

Multimodality Imaging in Cardiovascular Medicine Christopher M. Kramer, 2010-10-19 A Doody s Core Title 2012 New applications of echocardiography nuclear magnetic resonance cardiovascular magnetic resonance and cardiac computed tomography are rapidly developing and it is imperative that trainees and practitioners alike remain up to date in the latest developments It is

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