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COHORT PROFILE

The ESC-EORP EURO-ENDO (European Infective Endocarditis) registry

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Aims The European Society of Cardiology (ESC) EURObservational Research Programme (EORP) European Endocarditis (EURO-ENDO) registry aims to study the care and outcomes of patients diagnosed with infective endocarditis (IE) and compare findings with recommendations from the 2015 ESC Clinical Practice Guidelines for the management of IE and data from the 2001 Euro Heart Survey.

Methods and results Patients ($n = 3116$) aged over 18 years with a diagnosis of IE based on the ESC 2015 IE diagnostic criteria were prospectively identified between 1 January 2016 and 31 March 2018. Individual patient data were collected across 156 centres and 40 countries. The primary endpoint is all-cause mortality in hospital and at 1 year. Secondary endpoints are 1-year morbidity (all-cause hospitalization, any cardiac surgery, and IE relapse), the clinical, epidemiological, microbiological, and therapeutic characteristics of patients, the number and timing of non-invasive imaging techniques, and adherence to recommendations as stated in the 2015 ESC Clinical Practice Guidelines for the management of IE.

Conclusion EURO-ENDO is an international registry of care and outcomes of patients hospitalized with IE which will provide insights into the contemporary profile and management of patients with this challenging disease.

Keywords Infective endocarditis • Registry • Valve disease

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† A complete list of the EURO-ENDO Investigators is provided in the *Appendix 1*.

Introduction

Infective endocarditis (IE) is a lethal disease associated with not only high risk of death, but high rates of morbidity and healthcare expenditure.[1–6] Despite improvements in diagnostic and therapeutic strategies, the incidence and severity of the disease remain unchanged—largely driven by the evolving epidemiological profile of patients as well as an increasing number with prosthetic or device related IE.[7]

In addition to temporal changes in patient characteristics[1,7] over time, changes in key health service factors have occurred with potential impact on IE care and outcomes. These include the development of new diagnostic and therapeutic strategies for the management of IE,[2] publication of the 2015 European Society of Cardiology (ESC) Clinical Practice Guidelines on the management of IE,[8] the increasing recognition of the importance of the IE Team, and the availability of multi-modality imaging.[8] Notably, it remains uncertain whether recommendations for the use of early surgery in patients with complicated IE have been widely adopted and whether this is associated with better or worse clinical outcomes. Equally, there are limited international data regarding adherence to (and impact of) changing recommendations for IE antibiotic prophylaxis.

Given that the last major international survey of IE (the ESC Euro Heart Survey Programme dedicated to valvular heart disease) was performed in 2001[9] with no comprehensive surveys since then, there is a compelling need to undertake a contemporary international investigation of the care and outcomes of IE. We, therefore, designed and implemented the ESC EURObservational Research Programme (EORP) European Endocarditis (EURO-ENDO) international registry.[10]

Aim of EURO-ENDO

The aim of the EURO-ENDO registry is to undertake an international observational study to allow an up-to-date investigation of the care and outcomes of patients with IE. The primary objective of EURO-ENDO is to evaluate the outcome of patients diagnosed with IE. The secondary objectives are to assess the current clinical, epidemiological, microbiological, therapeutic, and prognostic characteristics of IE in Europe, to assess the current practices of imaging in IE in Europe and in affiliated countries, to assess the degree of implementation of the ESC guidelines in practice, and to compare these current data with those obtained in the Euro Heart Survey. The wide geospatial coverage of EURO-ENDO will allow regional investigation of the management and outcomes of patients hospitalized with IE.

Quality of care interventions

By means of an electronic case record form, individual patient data were collected across 430 unique data fields, including patient characteristics, clinical, biological, and microbiological data, the use of imaging procedures (and their results), antibiotic treatment, and surgical interventions. Diagnostic methods for IE, antibiotic treatment, indications for and the use of surgery, and the frequency and type of patient follow-up were not pre-specified by the study protocol.

Setting

University and non-university hospitals of any volume of activity within and beyond Europe were invited to join EURO-ENDO on a voluntary basis. All 57 ESC member countries were invited to participate in EURO-ENDO, with centres within the countries being selected by a National Coordinator from the country. Participating centres were categorized by the European Association of Cardiovascular Imaging as either high level IE centres: high volume of treated patients (≥20 patients per year) with expertise in IE diagnosis, management, imaging and surgical therapy, or low volume centres (<20 patients per year) without surgical capabilities, as self-reported by the participating centres.

Population and consent

From 1 January 2016 to 31 March 2018, centres were asked to include consecutive patients aged greater than 18 years over a 1-year follow-up period with a diagnosis of definite IE (or possible IE, considered and treated as IE) based on the ESC 2015 IE diagnostic criteria.[8] Since all centres were asked to include patients during a 1-year period and to obtain 1-year follow-up for all these patients, the total duration of participation of each centre was 2 years, with end of follow-up of the study on 31 March 2019. All participants received detailed written information concerning the study and provided signed informed consent. In total, 3116 index cases of IE from 156 centres across 40 countries were collected over the study period (*Figures 1* and *2*).

Patient identification

Potential participants were identified from echocardiographic laboratories and hospitals treating patients with IE and given a unique study number.

Start points

Any patient aged over 18 years and hospitalized between 1 January 2016 to 31 March 2018 with definite IE (or possible IE, considered and treated as IE) based on ESC 2015 diagnostic criteria.

Baseline and follow-up data

Baseline data included demographic data (site of inclusion, age), patient history (previous IE, at-risk situation or procedure, history of cardiovascular, and non-cardiac disease), clinical data (weight, height, date and timing of first signs and symptoms, temperature), previous cardiac or non-cardiac invasive intervention within the last 6 months (colonoscopy, dental procedure, urogenital, or gastrointestinal intervention), biological and microbiological data (sedimentation rate, C-reactive protein, creatinine, haemoglobin, white blood cells, platelet count, blood cultures, serology), echocardiographic data (vegetation, abscess, valvular and perivalvular lesions, valve regurgitation or stenosis), other imaging techniques (CT scan, PET-CT, cerebral or cardiac MRI), treatment before admission and during hospitalization (including antibiotic therapy and all other treatments), complications under therapy (embolic event, infectious and haemodynamic complications, theoretical indications for surgery, in-hospital mortality), interventional treatments (valve surgery), and 1-year complications (any hospitalization, recurrence of IE, and 1-year all-cause mortality).

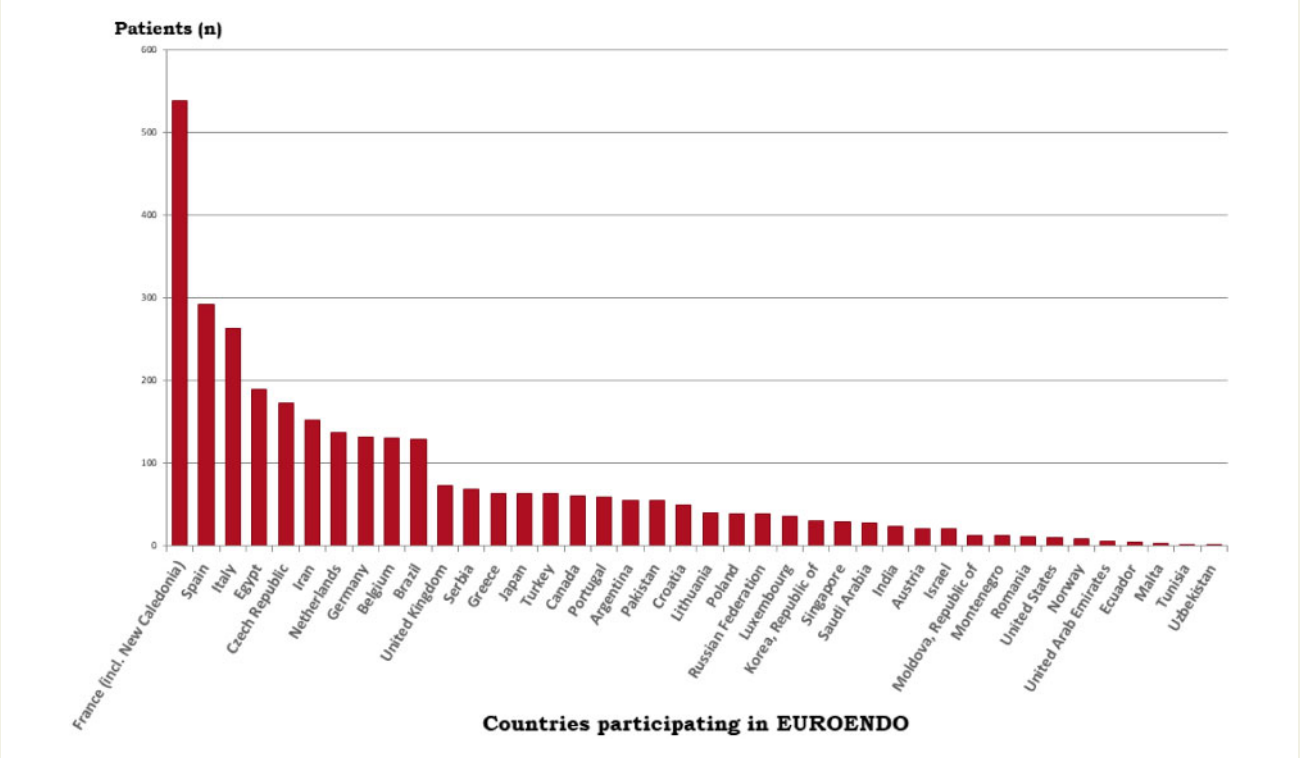

Figure 1 Numbers of patients included in the ESC EORP EURO-ENDO registry according to participating country.

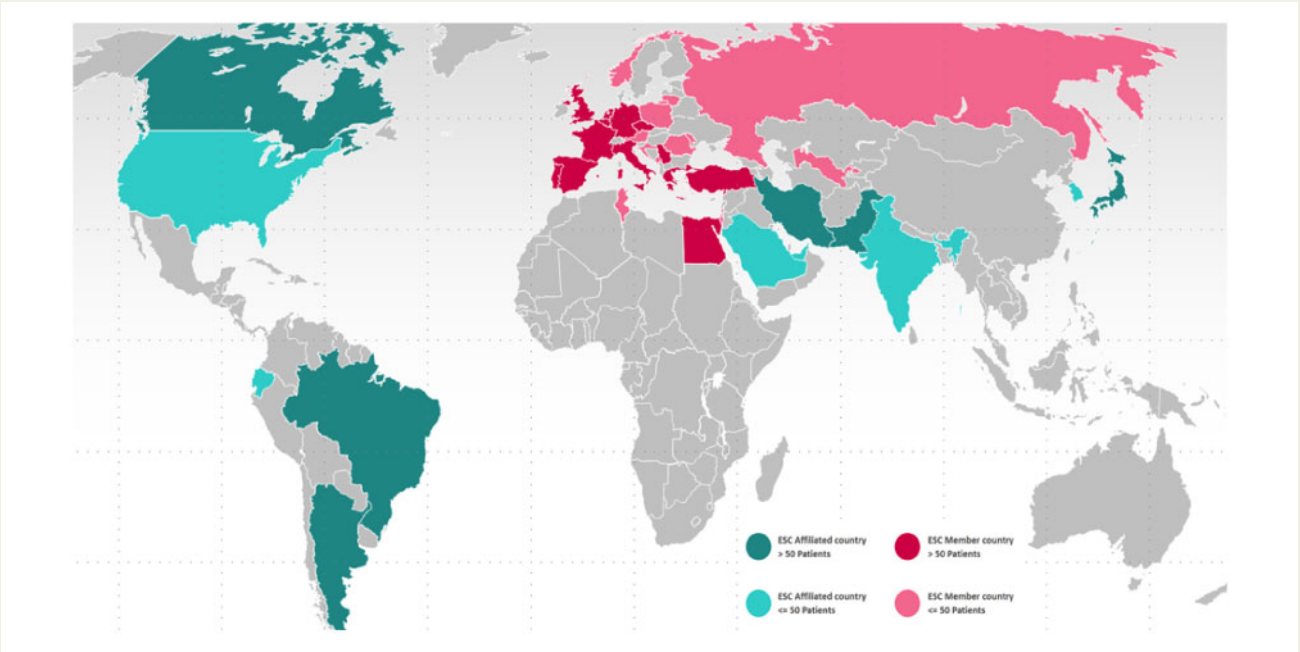

Figure 2 Countries participating in the ESC EORP EURO-ENDO registry.

Data capture and storage

Participant identifiable data were used to track subsequent clinical care and outcomes, with the identifiable data only residing on local centre computers. These data were then pseudonymized by means of a unique patient study code before electronic transmission via the ESC-EORP Data Entry System Security using SSL (Secure Sockets

Layer) network encryption to a dedicated secure server (Microsoft SQL Server 2012 Database server) at the central data warehouse (The European Heart House, France). Data Collection Officers and local investigators at participating centres had access to electronic case report forms through secure login on the EORP website. Individual login names and passwords were distributed by the EORP team to the participating centres.

Data quality

Data quality was monitored by the ESC EORP EURO-ENDO administrative team. This included edit checks (for missing data, date chronology, numeric value ranges) and a Data Validation Plan listing all the checks carried out to ensure data consistency and adherence to the protocol, including missing data, consistency of the chronology in the dates and between the data of the different visits of the study (cross checks), and the numeric values entered are included in the predefined ranges.

Endpoints and linkages to other data

The primary endpoints are in-hospital and 1-year mortality. Secondary endpoints are 1-year morbidity (any hospitalization, any cardiac surgery, IE recurrence), clinical, epidemiological, microbiological and therapeutic characteristics, number and timing of non-invasive imaging techniques, and implementation of the 2015 ESC Clinical Practice Guidelines for the management of IE. In-patient data are collected from hospital medical records, and 1-year follow-up data collected by contact with the participants via telephone calls and/or scheduled outpatient clinic appointments.

Conclusion

To our knowledge, the ESC EORP EURO-ENDO registry is the most comprehensive and far reaching observational cohort of patients hospitalized with IE. The registry will describe the contemporary profile of patients admitted to hospital with IE, their investigations, treatment and clinical outcomes, and document how we care for patients with IE in the light of recommendations from the 2015 ESC Clinical Practice Guidelines for the management of IE. EURO-ENDO will, for example, offer insight into the implementation and impact of changing recommendations for the use of IE antibiotic prophylaxis. In addition, since EURO-ENDO registry finally includes patients from four continents countries, it represents a unique opportunity to compare the characteristics of IE across the world. Although it will unavoidably suffer the limitations of such a registry (voluntary nature, international reach, lack of a central/core laboratory to review echo images and microbiological samples), and given the paucity of randomized and large-scale observational data, the ESC EORP EURO-ENDO registry offers a unique opportunity to provide key information about the current care and outcomes of patients with IE across a wide range of countries.

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Conflict of interest: G.H., B.P., R.C., B.C., E.D., P.A.E., C.P.G., J.T., P.L., B.P., A.S., A.S., S.F., C.L., M.M., P.T., M.P. declare no conflict of interest. B.I. reports personal fees from Edwards Lifesciences, personal fees from Boehringer Ingelheim, personal fees from Novartis, outside the submitted work. A.M. reports personal fees from Bayer, personal fees from Fresenius, personal fees from Novartis, outside the submitted work.

Appendix 1

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