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Retrospective study of the evolution of the incidence of non-traumatic lower-extremity amputations (2007–2013) and risk factors of reamputation

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ABSTRACT

Aim: Describe the incidence of non-traumatic amputation in a Spain region and identify the risk factors associated with the level of amputation and reamputation.
Methods: Retrospective study on non-traumatic lower-extremity amputees in a Spanish region between 2007 and 2013. A descriptive, bivariate and multivariate analysis was performed using bivariate logistic regression. Statistical significance $p \leq 0.05$, SPSS V.21.
Results: 495 amputations were carried out in 353 patients. 81.0% ($n = 286$) were men, mean age 68.7 ± 10.8 years. The most frequent levels of amputation were digital (45.9%) and above-knee (40.5%). About 30% of the patients were reamputated. The multivariate analysis revealed that the factors independently related to the need for a minor lower-extremity amputation were DM [OR 3.79 (CI 95% 2.0–7.27)], foot ulcer [OR 5.82 (CI 95% 2.24–15.11)] and previous ipsilateral amputation [OR 3.19 (CI 95% 1.21–8.42)]. The risk factors independently related to the need for reamputation were DM [OR 2.21 (CI95% 1.09–4.49)], smoking [OR 2.45 (CI95% 1.33–4.50)] and previous revascularization [OR 2.75 (CI95% 1.57–4.83)].
Conclusions: Determining the incidence of amputations in diabetic patients as an indicator of quality makes it possible for health services to be evaluated. In patients with DM the most common reamputations are minor and ipsilateral.

Abbreviations: DM, Diabetes Mellitus; ICD-9, International Classification of Diseases 9° edition; LEA, Lower Extremity Amputation; AHT, Arterial Hypertension; PAD, Peripheral Arterial Disease.

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1. Introduction

The prevalence of non-traumatic amputations has been decreasing in recent years [1–3] although there is still a long way to go before the objectives determined at the Sant Vicent Congress in 1989 are attained. The complications derived from diabetes mellitus (DM) and vascular pathologies are the main reason why these objectives have not been met. DM is regarded as a pandemic, the incidence of which is constantly rising [4,5]. In Spain, the last national study carried out showed that 14% of the population above 30 years of age suffered from DM, although about half of these had not been diagnosed [6]. One of the most important complications in DM is diabetic foot syndrome, which has a risk of onset of up to 25%. Of these, 2% will require amputation [7]. DM is the leading cause of lower-extremity amputation (LEA) in Europe and USA. The mean rate of LEA in people with DM in Western countries is 15×10^5, and the rate in USA is twice this. Korea and Austria, on the other hand, present rates below the mean [8].

There is a direct relationship between DM and peripheral artery disease (PAD). The presence of PAD in people with DM is estimated to be 8% at the moment of diagnosis, and increases to 45% after 20 years of evolution [9]. It is estimated to be 27% more frequent than in the general population [10].

In vascular surgery, the criteria for determining the need to perform a LEA depend on the extent of the ischemia, the impossibility of revascularization, a serious infection that will not abate, pain and a possible life-threatening risk for the patient. According to the evaluation carried out by the TASC group, the prevalence of PAD is between 3 and 10% of the population, which increases to 15–20% in people over 70 years old. The combination of PAD and DM increases the risk of amputation by 10 [11].

LEAs cause severe functional problems and affect quality of life [12,13]. Several countries have set up multidisciplinary teams to prevent and treat ulcers, and perform health interventions, the effectiveness of which has been proved by a decrease in the number of complications [14–16]. The decrease in the rates of LEAs is associated with the greater quality of the care provided by health services [17].

Some studies describe the prevalence of LEAs in different parts of Spain [3,18,19]. However, to date no specific study has been made of Catalonia, where the percentage of people with DM is lowest [20]. At the same time, studies need to be performed to show not only the incidence of the first LEAs but also the number of reamputations in this population in the course of time and the factors that affect their development.

The main aim of this study was to describe the prevalence of LEAs in a region of Catalonia, and identify the risk factors associated with reamputations and the level of resection.

2. Methodology

A retrospective study was carried out on non-traumatic lower-extremity amputees between 2007 and 2013. Bone tumour, congenital and upper-extremity amputations were excluded. The patients were identified with the International Classification of Diseases, ninth edition (ICD-9) [21], using the procedure codes for LEAs (84.11–84.18). Subsequently, the computerized medical histories of all the patients identified were subject to an in-depth review, and the data from the "admission" and "discharge" documents were collected.

Also collected were sociodemographic data, other comorbidities – DM, arterial hypertension (AHT), dyslipidemia, cardiovascular diseases, cerebrovascular accidents and smoking – and other information about the surgery, diagnosis on discharge, admission time in hospital, revascularization and death.

When a patient was admitted on more than one occasion, the demographic data were only recorded for the first admission.

2.1. Study population

The census for the province of Tarragona in 2007 revealed a total of 757,795 inhabitants, of whom 16.8% were more than 65 years old [22]. The teaching hospital under study is the hospital of reference for the province and, more specifically, the only one to have specialists in vascular surgery and angiology who can perform non-traumatic amputations.

2.2. Definition and classification of amputations

LEA was defined as the partial or total resection of the lower limb, through one or more bone structures and perpendicular to the longitudinal axis of the limb [23]. There were two types of amputation: major and minor. Major amputation was defined as being above the ankle (below-knee and above-knee) and minor amputation as being limited to the foot (from digital to Syme) [3].

2.3. Reamputation

Reamputation was defined as the second LEA performed on the same person. The reamputations considered were those performed at the ipsilateral level and on the same or a superior anatomical plane, or at the contralateral level. Surgical revision of the stump was not considered as an amputation [24].

2.4. Ethical issues

The study was assessed and approved by the hospital's Clinical Research Ethics Committee. The confidentiality of the data was guaranteed at all times in accordance with the stipulations of the Organic Law on Data Protection 15/1999. Because of the retrospective nature of the study there was no need to request the informed consent of the participants.

2.5. Statistical analysis

A descriptive analysis of the data was made with mean and standard deviation (SD), and absolute and relative frequencies (%). The bivariate analysis was performed using the chi-squared test, the Mann–Whitney *U*-test or Student's *T*-test. To evaluate the factors independently related to the level of amputation and the need for reamputation, multivariate binary logistic regressions were performed using the introduce