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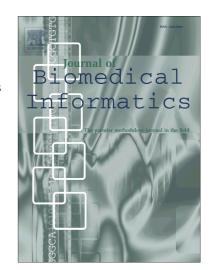
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Using Machine Learning Methods for Predicting Inhospital Mortality in Patients Undergoing Open Repair of Abdominal Aortic Aneurysm

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Abstract

An abdominal aortic aneurysm is an abnormal dilatation of the aortic vessel at abdominal level. This disease presents high rate of mortality and complications causing a decrease in the quality of life and increasing the cost of treatment. To estimate the mortality risk of patients undergoing surgery is complex due to the variables associated. The use of clinical decision support systems based on machine learning could help medical staff to improve the results of surgery and get a better understanding of the disease. In this work, the authors present a predictive system of inhospital mortality in patients who were undergoing to open repair of abdominal aortic aneurysm. Different methods as multilayer perceptron, radial basis function and Bayesian networks are used. Results are measured in terms of accuracy, sensitivity and specificity of the classifiers, achieving an accuracy higher than 95%. The developing of a system based on the algorithms tested can be useful for medical staff in order to make a better planning of care and reducing undesirable surgery results and the cost of the post-surgical treatments.

Keywords:
Machine learning, mortality prediction, abdominal aortic aneurysm, clinical decision support system, data analysis.

1. Introduction

An aneurysm is a progressive and localized dilation (a diameter increase over 50% of normal size) that compromises the three layers of a vessel. This disease is most common in overaged people, males, smokers, and those with a family history of aneurysms. It is also the tenth leading cause of death in men aged over 60 and it is becoming more and more common in women [1, 2]. Aneurysms are classified according to shape (fusiform, sacular), size (macroaneurysm, microaneurysms), placement (central, peripheral, visceral and cerebral) and structure (true and false). The most common location is infrarenal with an incidence from 2% to 6% in people over 60 years [3]. An abdominal aortic aneurysm (AAA) (Figure 1) is a focal dilation at some point of the abdominal section of the aorta [4]. Considering that the normal diameter is from 1.5 to 2.4 cm, aneurysms can be diagnosed when the transverse diameter of the aorta goes up to 3cm or greater [5]. Without any treatment the AAA leans to grow until rupture. For its treatment (reparation) there are two main techniques: open repair, which is an invasive surgical procedure; and the endovascular aneurysm repair, which is transcatheter procedure where a stent graft is inserted using a catheter in order to exclude the aneurysm from the blood circulation [4].

The AAA prevalence in the general population is between 1-1.5% [6] becoming a common disorder in elderly patients [3]. Regarding AAA diagnosed women, available literature shows a prevalence rate between

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