

## Prevalence of atrial fibrillation in postoperative cardiac surgery patients.

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**KEY WORDS:** atrial fibrillation, myocardial revascularisation surgery, electrocardiogram, coronary care unit.

### ABSTRACT

**Introduction.** New-onset postoperative atrial fibrillation after cardiac surgery is common, with rates of up to 60%, and has been associated with early and late strokes, but its association with other cardiovascular outcomes is less well known. The aim of this study is to perform a systematic review of studies reporting the prevalence of postoperative AF.

**Material and methods.** Systematic review structured according to the PRISMA system. After formulating the research question with the PICO system, a search was carried out in different databases for "*Atrial Fibrillation after cardiac surgery AND thoracic surgery*". Articles in both Spanish and English were selected, especially those published in the last 5 years. Articles with low scientific evidence were not selected. There was no conflict of interest and the work was carried out taking into account the bioethical principles of all research.

**Results.** In the end twelve articles were selected in accordance with election criteria for critical reading with the CASPe system. Each of the articles was classified according to author, year of publication, level of prevalence, socio-demographic data and level of SING evidence. The main biases that occurred were selection and publication biases.

**Conclusions.** The prevalence of postoperative AF is between 30% and 40% of patients undergoing cardiac surgery.

## INTRODUCTION

New-onset postoperative atrial fibrillation (POAF) is not benign and negatively affects postoperative outcomes and increases mortality. POAF is associated with increased perioperative death, strokes, heart failure and acute renal failure, thereby significantly increasing the length of hospital stay (1). The authors in their commentary (2) also associate postoperative atrial fibrillation with prolonged hospital stay, leading to higher health care costs and increased mortality after cardiac surgery. Effective prophylactic measures exist, such as corticosteroids and antiarrhythmics, although they are not widely used, perhaps because of their side effects and costs.

Given this situation, it is necessary to explore new improvements in the protocols and updated guidelines in the preoperative, trans and especially postoperative management of patients undergoing cardiac surgery. With this knowledge it is possible to assess the improvement in care by the nursing staff working in the ICU (*intensive care unit*) and CCU (*coronary care unit*), in order to provide quality care and warmth through direct and personalised care, since in the environment of the ICU and CCU, nurses are in a privileged position that allows them to create close relationships with patients(3).

AF is currently the most frequent arrhythmia in the postoperative period when it comes to cardiac surgery. Several studies have shown that it is associated with comorbidities such as heart failure, renal failure and systemic embolism; it occurs within the first 48 hours, increasing time in hospital and mortality (4). Coronary artery disease is the leading cause of mortality worldwide, with an increasing incidence. Under these circumstances, the importance of being aware of the morbidity and mortality associated with postoperative atrial fibrillation has led to a better understanding of the problem, as the effects on the postoperative period and the quality of life of users are negative (5, 6). Postoperative AF is the chaotic and disordered depolarisation of the atria by different wave fronts simultaneously resulting in the loss of mechanical function of atrial contraction that occurs between the first and twenty-first days postoperatively. It is multifactorial in origin although among the main triggering factors that occur due to extracorporeal surgery are oedema produced by the surgeon's manipulation and the rupture and cannulation of the atria. These precursors are first released during surgery, reaching a peak after 3 days, i.e. the plateau begins 72 hours later. The electroencephalogram shows an absence of P waves before each QRS, the P wave is replaced by a fibrillatory f wave that varies in size, shape and time and is characterised by a frequency of 350 to 400 per minute (23, 24).

## MATERIAL AND METHODS

Subsequently, the PICO® (Population, Intervention, Comparison, Outcome) strategy (25) was used to formulate the question and thus achieve searches focused on the target of the study. With the help of this tool we were able to obtain the greatest evidence-based information regarding the topic of study. We then followed the recommendations of the PRISMA® (Preferred Reporting Items for Systematic reviews and MetaAnalyses) guideline, which consists of producing a four-phase flow chart to document the rationale for the review and the data found in a transparent manner (26).

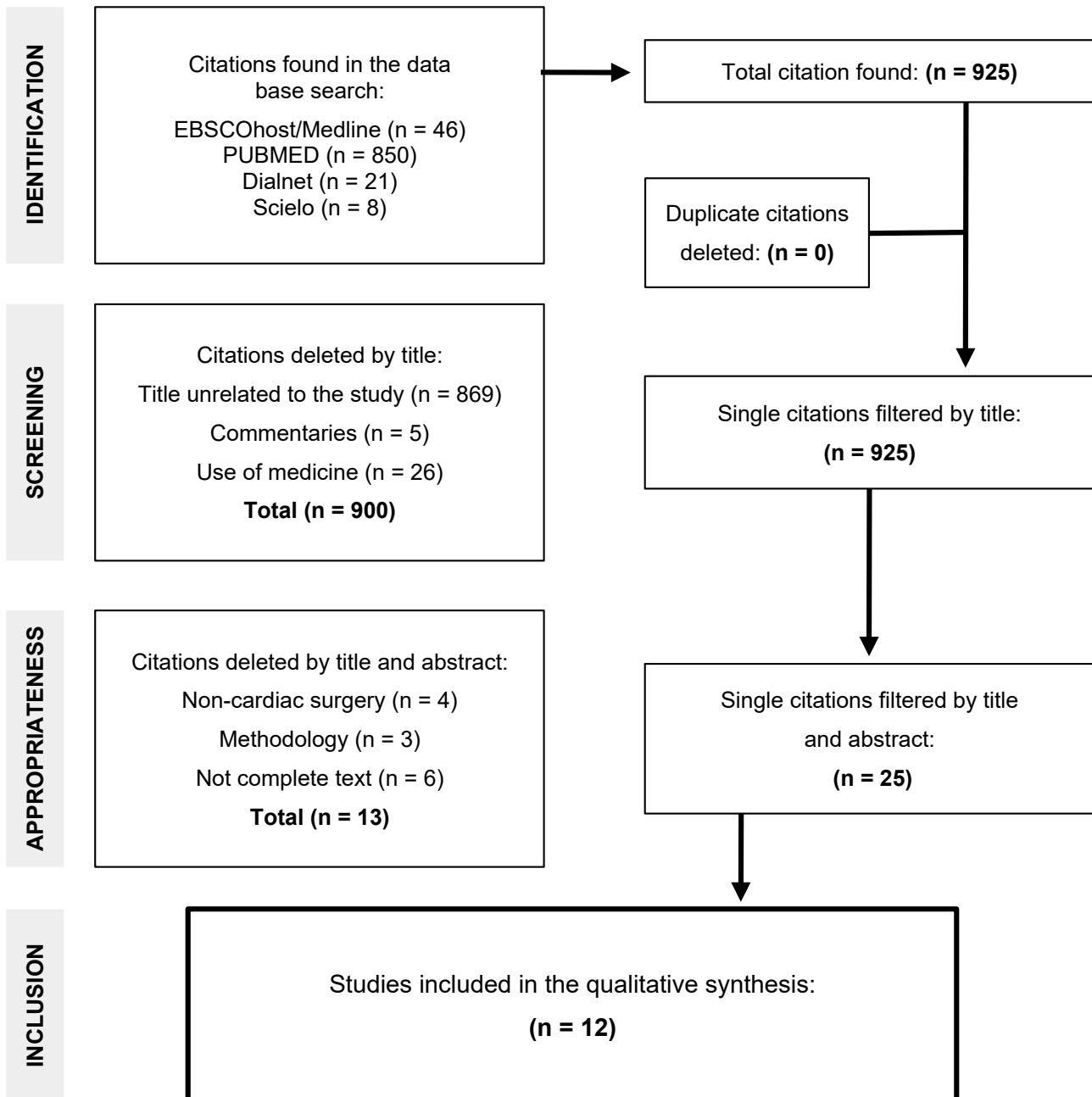
Research question (PICO): Q - Patients undergoing cardiac surgery may present different arrhythmias in the postoperative period, I - Systematic literature review on the arrhythmias presented by patients after cardiac surgery, especially atrial fibrillation (AF), C - Not applicable, O - AF is expected to have a high prevalence.

The search began in the MEDLINE® database via EBSCOhost® (27). This was followed by PUBMED® (28) and Dialnet® (29), and finally the SciELO® database (30). For the review and subsequent study of the scientific content, search strategies adapted to each database were designed. Firstly, based on the subject of the systematic review and the targets formulated, a series of keywords and Descriptors in Health Sciences® (31) (DeCs) were drawn up. When these terms had been consulted and validated by the scientific community, they then defined and clarified the search terms: atrial fibrillation, after surgery, postoperative period, cardiac surgery and thoracic surgery. MeSH (31) (Medical Subject Heading) terms were then created with the help of Boolean operators that limited and improved our search. Operators such as (AND, OR, NOT) were used, and with this structure we were able to create a simple and advanced search in each database.

The manual search strategies were mainly based on the review of the title and abstract. Firstly, it was decided that the articles selected from the terms should contain at least two health descriptors. Once the first selection had been made, the abstract was reviewed to check that the document dealt with a high percentage of the targets set forth in the paper. Once the articles had been selected, a screening process was carried out to eliminate duplicate articles, as well as articles whose titles were not related to the topic under study, articles where perioperative drugs were used and others that were just commentaries; in a second screening process, articles that did not evidence an appropriate methodology were discarded, as were those that did not have the full text. A critical reading of each and every one of the articles included was carried out, using the recommendations of the CasPe® tool (32) (Critical Appraisal Skills Programme Spanish), since clinical common sense is sufficient to interpret the evidence of what has been published and a critical reading of the same is required. We also worked with the quality of the evidence, adding the level of scientific evidence corresponding to each article based on the grades of recommendation of the Scottish Intercollegiate Guidelines Network (SIGN®) system (33).

## RESULTS

For the selection of the articles, several different search terms were used and inserted into the databases selected. This resulted in a total of 925 articles. After a first review, no duplicates were detected, so there were still 925. Subsequently, the first screening was carried out, in which the articles were first examined according to their title and 869 were eliminated; secondly, 13 articles were separated according to their title and abstract, considering the inclusion and exclusion criteria established in the study. The articles eliminated totalled 913, resulting in a total count of 12 articles for the qualitative analysis of the Systematic Review. The article selection process is reflected in the flow chart suggested by the PRISMA® guide.



Article selection process (Source: Designed in-house)

The studies selected for our research were carried out in 11 different countries from 4 continents; from America there were two articles from the USA, and one each from Cuba and Argentina; from Europe there was one article each from the Netherlands, Austria, Germany and the United Kingdom; South Korea and Japan from Asia with 1 article each and finally Australia, from Oceania, also with 1 article. There was one study that was carried out by three different countries (USA, Italy and Argentina).

In relation to the type of study, the vast majority are cohort studies, at 75%, followed by meta-analyses at 16.7%. The studies with the lowest incidence (8.3%) are randomised clinical trials.

The SIGN® levels of evidence also differed according to the type of studies in our systematic review. At 41.7%, studies with a SIGN® 2++ predominate; these are “high-quality systematic reviews of case-control or cohort or high-quality studies, with very low risk of confusion, bias or chance and a high probability that the relationship is causal”. 33.3% were studies with a SIGN® of 2+; “well-conducted cohort or case-control studies with a low risk of confusion or bias and a moderate probability that the relationship is causal”, followed by 16.7% 1++ studies; “high-quality meta-analyses, systematic reviews of RCTs or RCTs with a very low risk of bias”. In this case it should be noted that 58% of the studies selected boast a high level of scientific evidence, with a SIGN range between 1++ and 2++.

From the different articles found, it was possible to extract different quantitative information regarding the prevalence of postoperative atrial fibrillation, for which the data expressed by the authors has been taken and an average of 32.83% was obtained.

In the bibliography consulted, the different triggering factors mentioned by the authors in their studies can be analysed; the articles by L.M. Burgos et al. (36) and U. Benedetto et al. (41) do not clearly establish any specific factor.

Within the data obtained from each study, an age (mean) was used in all of them. A contingency table was designed where it is evident that the research by G.N. Katuska et al. (43) has the lowest range of mean age at 46.9, while M.P. Ehrlich et al. (38) reflects a high range of 75.5. Finally, a mean age of 68.8 was obtained.

Still with the socio-demographic characteristics according to sex, most of the articles have shown that postoperative AF occurs with a higher incidence in the male sex, except for the study by M.J. Kawczynski et al. (35) in which the female sex obtained a percentage of 52.7%.

## DISCUSSION

AF is the most common cardiac arrhythmia in the adult population, and contributes greatly to cardiovascular morbidity and mortality. One of the causes of AF is cardiac surgery, after which postoperative atrial fibrillation is common, showing an incidence of 30-40% (44).

According to studies conducted in different countries, the prevalence rates of postoperative AF vary in the results obtained either because of the sample size or the type of methodology. The authors C. Bening et al. (40) and G.N. Katuska et al. (43) presented their cases in which the first study evaluated 239 patients over a period of two years, obtaining a result of 16.5% prevalence of postoperative AF compared to the second study where the sample was 139 patients evaluated over a period of 8 years, where postoperative AF was evident in 18.4% of cases. We can see that the sample size and the evaluation period varies with a medium high margin, but the level of prevalence shows some similarity; it is, however, still well below what is reflected in the different studies.

M.J. Kawczynski et al. (35) showed a prevalence of 33.7% with a much higher study sample (20,201) compared to the previous authors. Likewise, the study by T. Amar et al. (42) obtained a very similar prevalence (30%), and within the range delimited by the new references, which is 30-40% (44). It seems possible that these similar results were due to the sample size, which in these studies exceeds twenty thousand and the study period was the same in both cases (8 years).

In contrast to other studies where the prevalence of postoperative AF was present in 100% of the cases studied, there was a sample of only 10 patients who were evaluated over a period of one year and who presented with postoperative AF between day 2 and 60 as mentioned in the research by M.P. Ehrlich et al. (38). It can be seen that the values lie outside the mean of the other studies, based on the findings of the literature review consulted.

A study was conducted in Spain in 2007 involving a total of 102 patients, only 23 of whom presented atrial fibrillation after cardiac surgery, i.e. a prevalence of 23% (45). This prevalence is similar to the study by M.D. Kertai et al. (34) and U. Benedetto et al. (41), whose results reflect a prevalence of 24.7% and 24.3% respectively; the study samples were completely different, ranging from 1000 to 3000 patients under study. With all these results and the literature reviews consulted, the range in which postoperative atrial fibrillation develops in the majority of cases, i.e. between 20 and 40% of patients undergoing cardiac surgery have postoperative AF, could be suggested.

In the case of postoperative atrial fibrillation (46), they consider certain predictors such as age, sex and left atrial measurements. Likewise, in the study on Epidemiology and new predictors of postoperative AF (45) they mention age, sex, previous history of AF, and left ventricular ejection fraction as triggering factors for postoperative atrial fibrillation, thus arriving at the same predictors.

No similarity with other factors has been found, as different studies reveal various different predictors of postoperative AF, starting with the genetic factor mentioned by M.D. Kertai et al. (34), where they validated a genetic marker in comparison with conventional clinical risk factors. Within this field the research carried out by M.P. Ehrlich et al. (38) also addresses the issue of genetics, but much more in depth in myocardial cells as it suffers alterations of the atrial substrate and mitochondrial dysfunction which causes AF. Heart failure was presented as a factor in the studies of K. Woldendorp et al. (37) and T. Amar et al. (42), in which a CHA2DS2VASc model was applied; this is a risk stratification tool for the prediction of new AF after cardiac surgery.

Regarding the age of patients presenting postoperative AF, the majority are old. Tulio Caldonazo et al. (47) state in their review that the mean age ranged from 54.6 to 77.4, but do not define a percentage incidence rate for gender. Following this line, the study by D. Miklos et al. (34) obtained a mean age very similar to the previous one, ranging from 55.6 - 71.6 with a median of 63.9, but he does talk about the prevalence of sex, where 39% of patients presenting postoperative AF are female. In the papers,

the ages are disparate, but a common factor is that all participants are elderly. On this basis the research by G.N. Katiuska et al. (43) reflects the lowest mean age compared to the other authors, with a mean of 46.9; a significant difference from the value of the literature review. We also have a high mean age value compared to the study by D. Miklos et al. (34), as it reflects a mean age of 75.5, well outside the range of said study. The other studies fall within the range of mean age as scored by Tulio Caldonazo et al. (47); the closest mean value is U. Benedetto et al. (41) with a mean age of 66.4.

Still with the socio-demographic characteristics according to sex, as mentioned in D. Miklos et al. (34), the female sex accounted for only 39% of the patients with postoperative AF, which means that the male sex has a greater predisposition to develop atrial fibrillation in the postoperative period. It is worth noting that there are two exceptions – the study by M.J. Kawczynski et al. (35), where the female sex was in the majority at 52.7%, while a somewhat similar value was shown in the study by M.P. Ehrlich et al. (38), in which the female and male sexes accounted for 50% each, i.e. out of the 10 patients who took part in the study, 5 were female and 5 were male. In this situation, in seven studies, the male sex had a prevalence of more than 70% compared to the female sex, which did not even reach 30%.

### **Limitations of the study**

Due to the degree of complexity involved in a Systematic Review, starting with the biases, as well as the amount of inconclusive or impossible information found, there were certain problems when making decisions on the choice and grouping of the articles found. Undoubtedly, one learns by researching, and despite having a good theoretical basis, in practice problems and improvements in the review became evident.

### **Future lines of research**

As future lines for randomised clinical trials on postoperative AF, it would help to provide sufficient knowledge to update procedures and clinical guidelines for a better management and approach to patients undergoing cardiac surgery.

## CONCLUSIONS

The prevalence of atrial fibrillation in the context of postoperative cardiac surgery patients has been shown to be 32.83%, a low average incidence rate, since it is the most common arrhythmia that occurs in the postoperative period, whether in the intensive care or coronary care area. This leads to an increase in the length of stay, costs and therefore increases the risk of mortality in patients who in most cases have a stroke some time after undergoing cardiac surgery.

The triggering factor for atrial fibrillation has been defined as being multifactorial in origin, as there is still no specific factor that develops postoperative atrial fibrillation. Several factors are mentioned, including genetic and cellular factors of the heart, as well as heart failure as a predisposing factor, and at the structural level of the left heart, dysfunction of the left ventricle and reduced contractility of the left atrium; independently or together all these factors contribute to the development of AF in the postoperative period.

The socio-demographic characteristics are described, especially the age and sex of the patients who underwent cardiac surgery, with the profile being that of elderly patients, i.e. older adults, since due to their age there is a greater ageing of the cardiac cells, which leads to inadequate functionality of the cardiac muscle; in relation to sex, it is mostly related to male patients in a 3 to 1 ratio over the female gender.



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