

# Cardioversion of uncomplicated paroxysmal atrial fibrillation: a survey of practice by Canadian emergency physicians

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## ABSTRACT

**Objective:** Paroxysmal atrial fibrillation (PAF) is the rhythm disturbance most commonly encountered by emergency physicians, yet the role played by emergency physicians in the management of this condition has not been well described. The purpose of this study was to describe the management of uncomplicated PAF by Canadian emergency physicians.

**Methods:** All members of the Canadian Association of Emergency Physicians with a Canadian address ( $n = 1255$ ) were mailed a 15-point questionnaire regarding training/certification, hospital demographics and practice patterns regarding the management of uncomplicated PAF. Chi-squared analysis and Fisher's Exact test were performed to identify significant differences in reported practice patterns in relation to demographic variables. Significant associations were tested for interaction using the Mantel-Haenszel test.

**Results:** We received 663 responses, representing a 52.8% response rate. Six hundred and twenty-two (95%), 514 (78%) and 242 (38%) respondents reported routine performance of rate control, chemical cardioversion and electrical cardioversion respectively. Physicians working in high-volume emergency departments (>50 000 visits/yr) were significantly more likely to self-manage rate control and chemical/electrical cardioversion than those working in lower volume emergency departments. Residency training was associated with higher performance of electrical (44% v. 31%,  $p < 0.01$ ) but not chemical cardioversion or rate control, although, amongst residency trained physicians, those with FRCP-level training were significantly more likely to perform both chemical (86% v. 76%,  $p < 0.05$ ) and electrical (57% v. 37%,  $p < 0.01$ ) cardioversion.

**Conclusion:** Canadian emergency physicians surveyed in this study actively manage uncomplicated PAF. We found significant variations in practice, especially related to the use of electrical cardioversion. This may reflect different practice environments, levels of training, and lack of evidence to guide best practice. Further research is required to determine the optimal care of PAF in the emergency department setting.

**Key words:** paroxysmal atrial fibrillation; emergency management; cardioversion

## RÉSUMÉ

**Objectif :** La fibrillation auriculaire paroxystique (FAP) est le trouble du rythme le plus souvent rencontré par les médecins d'urgence. Or, le rôle que jouent les médecins d'urgence dans la prise en charge de cette atteinte n'a pas été bien défini. La présente étude avait comme objectif de décrire la prise en charge d'une FAP non compliquée par les médecins d'urgence canadiens.

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**Méthodes :** Tous les membres de l'Association canadienne des médecins d'urgence ayant une adresse canadienne ( $n = 1255$ ) reçurent par la poste un questionnaire en 15 points concernant leur formation/certification, le profil démographique de leur hôpital et leurs habitudes de pratique pour ce qui est de la prise en charge de la FAP non compliquée. L'analyse du chi carré et la méthode exacte de Fisher furent appliquées pour identifier les différences significatives dans les habitudes de pratique décrites par rapport aux variables démographiques. Les associations significatives furent mises à l'épreuve quant à l'interaction à l'aide du test Mantel-Haenszel.

**Résultats :** Nous avons reçu 663 questionnaires remplis, pour un taux de réponse de 52,8 %. Six cent vingt-deux répondants (95 %) dirent recourir de façon routinière à la maîtrise du rythme, 514 (78 %) à la cardioversion chimique, et 242 (38 %) à la cardioversion électrique. Les médecins qui travaillaient dans des départements d'urgence recevant un grand nombre de patients ( $> 50\,000$  visites/année) étaient beaucoup plus susceptibles de prendre en charge eux-mêmes la maîtrise du rythme et la cardioversion chimique/électrique que les médecins oeuvrant dans des départements d'urgence moins achalandés. La formation de résident était associée à un recours plus fréquent à la cardioversion électrique (44 %, 31 %,  $p < 0,01$ ) mais non à la cardioversion chimique ni à la maîtrise du rythme, bien que parmi les médecins ayant une formation de résident, ceux ayant une certification FRCP étaient beaucoup plus susceptibles de recourir à la cardioversion tant chimique (86 % v 76 %,  $p < 0,05$ ) qu'électrique (57 % v 37 %,  $p < 0,01$ ).

**Conclusion :** Les médecins d'urgence canadiens ayant répondu à cette étude exercent une prise en charge active de la FAP. Nous avons trouvé des variations significatives dans les habitudes de pratique, surtout en ce qui a trait au recours à la cardioversion électrique. Ce phénomène est probablement le reflet de différences au niveau de l'environnement de pratique, du niveau de formation et du manque de preuves pour guider la meilleure pratique. Des recherches plus poussées s'imposent afin de déterminer les soins optimaux de la FAP au département d'urgence.

## Introduction

Atrial fibrillation is the most common sustained cardiac rhythm disturbance, with prevalences of under 1% for patients age 50 to 60, rising to almost 10% in those in their 9th decade of life.<sup>1</sup> Uncomplicated paroxysmal atrial fibrillation (PAF) is the term used to describe recurrent episodes of atrial fibrillation lasting less than 48 hours that resolve spontaneously or require medical intervention for the restoration of sinus rhythm. The traditional approach to the management of PAF has been rate control and initiation of basic work-up in the emergency department (ED) followed by referral for definitive management.<sup>2</sup> Current management guidelines and recommendations<sup>3-5</sup> are based on this approach but do not address the role of emergency physicians (EPs) or electrical cardioversion performed by EPs for stable patients with PAF.

The safety and effectiveness of cardioversion (both chemical and electrical) of uncomplicated PAF by EPs followed by discharge home from the ED has been evaluated retrospectively,<sup>6</sup> and this practice appears to be safe. It may be preferable to the traditional practice because it may minimize the duration of atrial fibrillation, potentially reduce costs and shorten the length of stay in the ED.

Many Canadian EPs are comfortable managing patients with PAF; however, details of individual practice patterns

are unknown. Our objective was to poll the membership of the Canadian Association of Emergency Physicians (CAEP) with regard to their management of uncomplicated PAF. We also explored associations between management practices and the characteristics of the treating physicians.

## Methods

A 15-point survey instrument was piloted on local colleagues. In October 1999 all members of CAEP with a Canadian address ( $n = 1255$ ) were mailed a questionnaire on their training, certification, hospital demographics and practice patterns with regard to the management of uncomplicated PAF. The final response was received on Dec. 16, 1999.

Consideration was given to the Dillman approach to survey methodology (e.g., a user-friendly questionnaire, use of first class mail, return envelopes with first class stamps), however the budget of this project did not allow for multiple mail contacts, personalized correspondence or token pre-paid financial incentives as per standard Dillman methodology.<sup>7</sup> Our survey was done using a single mailing.

Data were entered into an Excel spreadsheet and imported into SAS version 8.2 for analysis. Significant differences in practice patterns and demographic variables were identified by performing chi-squared analysis and Fisher's Exact test. The Mantel-Haenszel test was used to assess

the association between 2 variables while controlling for the effects of another variable.

## Results

We received 663 responses to the single mailing, which represented a 52.8% response rate. Baseline demographic variables are shown in Table 1. Four hundred and twenty-three (64%) respondents were full-time EPs, and 326 (50%) had completed training in emergency medicine. These proportions closely approximate the membership of CAEP (80% of members are full-time EPs and 57% have completed residency training). Because so few respondents

worked in lower-volume centres (587 [90%] of respondents worked in EDs with an annual census of over 20 000 visits/yr), data were re-classified as low volume (<50 000 visits/yr) and high volume (>50 000 visits/yr) for subsequent analysis.

As shown in Figure 1, 622 (95%) respondents routinely initiate therapy to control ventricular response, and 514 (78%) initiate chemical cardioversion in patients with uncomplicated PAF. Only 242 (38%) respondents reported routinely performing electrical cardioversion. Among those who do, 240 (99%) initially attempt chemical cardioversion and reserve electrical cardioversion for when chemical cardioversion fails.

Table 2 summarizes physician practice patterns for rate control, chemical cardioversion and electrical cardioversion as related to demographic variables. Physicians practising in high volume centres reported significantly ( $p < 0.02$ ) higher self-management rates for each therapeutic manoeuvre. Residency training was associated with higher performance of electrical cardioversion, but not other therapeutic manoeuvres. Residency-trained physicians were significantly more likely to perform electrical cardioversion themselves compared to non-residency-trained physicians (44% v. 31%,  $p < 0.01$ ). Within the residency-trained group, respondents who had completed FRCP-level training reported higher self-management rates for all therapeutic manoeuvres, and these differences were statistically significant for both chemical cardioversion ( $p = 0.04$ ) and electrical cardioversion ( $p < 0.01$ ). We observed a correlation between an increase in the number of patients with PAF a respondent saw per month and an increase in self-management rates of both chemical and electrical cardioversion. As shown in Table 2, this effect was modest overall and only reached statistical significance ( $p = 0.04$ ) for chemical cardioversion.

**Table 1. Demographics and practice characteristics of the 663\* respondents in the study**

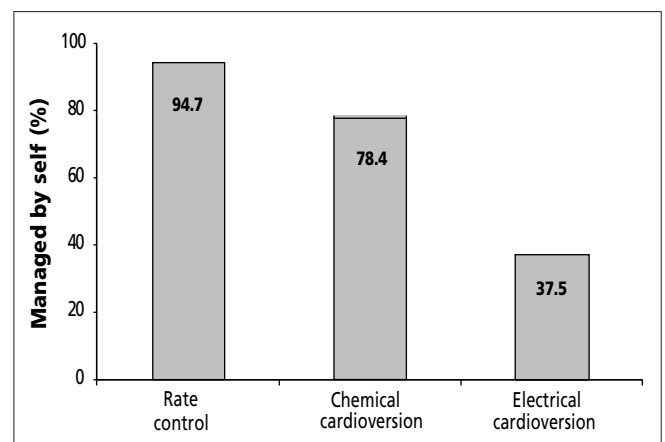
| Characteristics   | No. (and %)† of physicians |
|---|----------------------------|
| <b>Professional time in ED, %</b>                           |                            |
| <25   | 69 (10.5)                  |
| 25–50   | 75 (11.4)                  |
| 51–75   | 90 (13.7)                  |
| 76–100  | 423 (64.4)                 |
| <b>ED census</b>  |                            |
| <10 000   | 26 (4.0)                   |
| 10 000–19 999   | 40 (6.1)                   |
| 20 000–50 000   | 315 (48.2)                 |
| >50 000   | 272 (41.7)                 |
| <b>Country of medical training</b>                          |                            |
| Canada  | 633 (95.5)                 |
| United States   | 0 (0)                      |
| Other   | 30 (4.5)                   |
| <b>Residency in EM</b>                                      |                            |
| Yes   | 326 (49.7)                 |
| No  | 330 (50.3)                 |
| <b>If Yes‡</b>  |                            |
| CCFP (EM)   | 256 (78.5)                 |
| FRCP  | 131 (40.2)                 |
| Other   | 24 (7.4)                   |
| <b>Country of EM training</b>                               |                            |
| Canada  | 462 (94.5)                 |
| United States   | 14 (2.9)                   |
| Other   | 13 (2.7)                   |
| <b>Years in practice, mean (and SD)</b>                     | 10.31 (7.6)                |
| <b>Estimated no. of patients with PAF treated per month</b> |                            |
| <3  | 308 (46.9)                 |
| 3–10  | 291 (44.3)                 |
| >10   | 58 (8.8)                   |

\*Not all groups total 663 because some respondents did not answer every question.

†Unless otherwise stated.

‡Total does not equal 100% because some respondents completed more than one type of residency training.

ED = emergency department; EM = emergency medicine; SD = standard deviation; PAF = paroxysmal atrial fibrillation.



**Fig. 1. Practice patterns of the 663 respondents**

Fifty percent of respondents had performed an elective electrical cardioversion for a patient with uncomplicated PAF at least once. Of these, 5% reported having some difficulty with the procedure. Residency-trained EPs had a slight but significant increased likelihood of electively performing electrical cardioversion compared to non-residency trained physicians (56% v. 44%,  $p = 0.002$ ). Additionally, we found a significant positive association ( $p = 0.004$ ) between how many patients with PAF the respondent had seen and the respondent's likelihood of ever having performed electrical cardioversion.

When physician practice was evaluated based on number of years in practice, it appeared that physicians with either the least or most experience were more likely to perform both chemical and electrical cardioversion. This effect overall was very small, and when the Mantel-Haenszel test was performed (controlling for other demographic variables individually), number of years in practice was not significant as an independent predictor of physician practice.

## Discussion

This survey is important because it is the first large survey of EP management of patients with PAF. Our key finding

of significant practice variation among Canadian EPs suggests a lack of evidence to guide practice and demonstrates a need for further research to determine the optimal care of this condition in the ED. Of the 663 EPs who responded, almost all independently manage rate control, a large majority initiate chemical cardioversion and approximately one-third routinely perform electrical cardioversion for uncomplicated PAF. This information may serve as a point of reference for those interested in developing practice guidelines or developing research projects regarding the ED management of patients with PAF.

The determinants of physician practice patterns related to the ED management of PAF appear to be multi-factorial, with ED volume, physician experience with PAF patients, and training all playing a role. Physicians working in centres with more than 50 000 ED visits/yr were significantly more likely to self-manage patients with PAF by rate control or with chemical or electrical cardioversion than physicians working in centres with lower annual volumes. The reasons for this finding are unclear. Although physicians practising in busier centres may gain confidence in the performance of procedures through greater exposure, it seems counterintuitive that these physicians would have more time for labour-intensive procedures such as electrical car-

**Table 2. Proportion of patients self-managed by their physician, according to the practice characteristics of the 663 respondents\***

| Practice characteristics                                    | No. of respondents | Rate control, % | Chemical cardioversion, % | Electrical cardioversion, % |
|---|--------------------|-----------------|---------------------------|-----------------------------|
| <b>Full time</b>  |                    |                 |                           |                             |
| <75%  | 234                | 93              | 79                        | 38                          |
| ≥75%  | 422                | 95              | 77                        | 36                          |
| <b>ED census</b>  |                    |                 |                           |                             |
| <50 000   | 375                | 93†             | 74‡                       | 30†                         |
| ≥50 000   | 276                | 97              | 84                        | 47                          |
| <b>Residency in EM</b>                                      |                    |                 |                           |                             |
| No  | 324                | 93              | 78                        | 31                          |
| Yes   | 316                | 96              | 79                        | 44‡                         |
| <b>If Yes</b>   |                    |                 |                           |                             |
| CCFP (EM)   | 200                | 96              | 76                        | 37                          |
| FRCPC   | 111                | 97              | 86†§                      | 57†§                        |
| <b>Estimated no. of patients with PAF treated per month</b> |                    |                 |                           |                             |
| 0–2   | 307                | 93              | 75                        | 35                          |
| 3–10  | 291                | 96              | 79                        | 38                          |
| >10   | 58                 | 93              | 90†                       | 47                          |

ED = emergency department; EM = emergency medicine; PAF = paroxysmal atrial fibrillation

\*Not all groups total 663 because some respondents did not answer every question.

† $p < 0.05$

‡ $p < 0.01$

§Denotes level of significant difference between types of residency training.

Note: All  $p$  values based on Fisher's Exact test.

dioversion. There are likely many factors associated with busier EDs (increased availability of specialist back-up, multiple physicians on duty at any given time) contributing to this pattern of practice. Definitive conclusions regarding this finding await further investigation.

We did evaluate the impact of residency training and number of patients with PAF seen per month on practice patterns. There was no uniform effect of either of these variables on physician practice. We observed an effect of residency training on referral practice for electrical cardioversion, with residency-trained residents reporting higher self-management rates for this procedure than non-residency-trained physicians. Additionally, there appeared to be a positive correlation between length of residency program and practice patterns; those with more training were more likely to perform procedures (see Table 2).

If we accept that the goal of managing PAF is the maintenance of sinus rhythm, our finding that a significant majority of Canadian EPs routinely make the decision to perform cardioversion in stable patients with PAF makes sense. There is ample evidence that early cardioversion is more likely to successfully restore and maintain sinus rhythm.<sup>8–17</sup> Higher success rates for early cardioversion may be related to atrial fibrillation induced “electrical remodeling” of atrial myocytes.<sup>18</sup> Experimentally induced electrical remodeling of atrial tissue begins within minutes.<sup>19–21</sup> These changes may result in alteration of normal contractility of atrial tissue, known as “atrial stunning,” predisposing the development of atrial thrombus. The duration of atrial stunning has been shown to be proportional to the duration of atrial fibrillation.<sup>22,23</sup> If the treatment decision is to attempt to restore sinus rhythm, the best chance for success likely lies in early restoration.

Although there is evidence that restoration of sinus rhythm by EPs using strategies such as electrical cardioversion is safe and effective,<sup>6,24</sup> a key question is this: What should the ED management of uncomplicated PAF be? Some studies have demonstrated that patients in sinus rhythm have better functional capacity<sup>25</sup> and quality of life.<sup>26</sup> In contrast, the AFFIRM trial<sup>27</sup> demonstrated increased hospitalizations, drug side effects and a tendency toward increased mortality in atrial fibrillation patients in whom the primary goal was to maintain sinus rhythm as opposed to simple rate control. There was no difference in the rate of stroke between the 2 groups. These findings have been confirmed by several smaller studies.<sup>28,29</sup> The abovementioned trials enrolled patients who had episodes of atrial fibrillation lasting more than 48 hours (in some cases many months), making their relevance to the ED management of PAF uncertain. Clearly there is a need for

future studies addressing the management of PAF in the first hours after the onset of the arrhythmia.

### Limitations

There are several important limitations to our study. Budgetary considerations prevented us from using the standard Dillman approach to survey administration, which may have contributed to our overall low (52%) response rate. It is possible that this response rate may have resulted in a sampling or coverage error bias influencing our conclusions. These considerations do not diminish our finding that hundreds of Canadian EPs play an active role in the management of PAF, routinely and independently performing both chemical and electrical cardioversion.

### Conclusions

Many EPs in Canada routinely manage uncomplicated PAF, although there is significant variation in practice. We feel this variation reflects a lack of evidence regarding the optimal ED management of this condition. Initial studies appear to indicate that patients fare equally well when chemical cardioversion and electrical cardioversion are performed by EPs or by cardiologists.<sup>6,24</sup> However, there is clearly a need for solid evidence generated from ED-based prospective clinical trials to better define the ED management of PAF.

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**Competing interests:** None declared.

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