Management of acute atrial fibrillation in the emergency department: a systematic review of recent studies

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The aim of the study was to provide an overview on the current evidence on the method of cardioversion in patients presenting with recent-onset atrial fibrillation at the emergency department. ISI Web of Science and MEDLINE were explored for articles published between January 2000 and December 2011 in English or Spanish for the keywords 'acute', 'recent-onset' or 'paroxysmal' AND 'atrial fibrillation' AND 'treatment' AND 'emergency'. Original published articles were included if they enrolled patients with atrial fibrillation episodes of short duration (<48 h) and if they specifically addressed time to conversion, length of stay in the emergency department, safety, and/or relapses. Data extracted included the number of patients included, agent(s) studied, type and level of evidence of the article, rate of sinus rhythm conversion, time to conversion, discharge rate, length of stay, adverse events, embolic complications, and relapses. Fourteen papers were included in the review, eight of them prospective and randomized. Cardioversion in the emergency department had an overall high rate of conversion and few side-effects and/or embolic complications. Direct current cardioversion was the most effective therapeutic strategy in terms of sinus rhythm restoration, rate of discharge, length of stay, and safety. Class I drugs were also effective in a selected population. Amiodarone had a longer conversion time, with a similar rate of acute adverse events. Cardioversion in the emergency department is feasible and safe. Direct current cardioversion is the most effective therapeutic strategy. *European Journal of Emergency Medicine* **00:000–000** © **2012 Wolters Kluwer Health | Lippincott Williams & Wilkins.**

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Introduction

Atrial fibrillation (AF) is the most common arrhythmia managed in the emergency department (ED) [1,2]. The management of recent-onset AF in ED, whether first detected or recurrent episodes, is controversial [3,4]. Although the rhythm control strategy does not increase survival in the long term in the general population [5,6], re-establishment of sinus rhythm (SR) in the short-term management is recommended for patients with recent-onset AF to control symptoms, improve hemodynamic status, and shorten hospitalization. Early successful cardioversion may also reduce the incidence of recurrent AF [7–10]. Ways to achieve restoration of SR include synchronized direct current cardioversion (DCC) and pharmacological cardioversion (PhC). The former is effective and safe in stable AF patients [11,12], but requires sedation and 6 h of fasting. The latter is limited by drug-related adverse effects and lower conversion rates compared with DCC [12,13]. The observation approach (rate control and wait for spontaneous conversion) is also accepted on the basis of the fact that many patients who present with AF convert to SR spontaneously [14].

Although there are many studies comparing different strategies in different settings up to 2000, very few data exist on the optimal way to restore SR in patients presenting with recent-onset AF in the ED by emergency physicians [15]. Over previous years, increasing literature has focused on the ED. This setting has special features that make it impossible to translate the results obtained under this setting to settings other than the ED itself. One of these features is overcrowding, which is a complex issue that has emerged as a health care crisis over the last decade in many EDs, and that can influence the kind and quality of care [16,17]. The cause of overcrowding is multifactorial, but prolonged ED length of stay and lack of hospital beds are important factors [18]. Thus, the special conditions in the ED can not only influence treatment but also imply that endpoints other than conversion to SR, such as length of stay in the ED or avoiding hospital admission, could be of interest. Overcrowding and other features of the ED, such as unpredictability, could also influence AF treatment in terms of feasibility and safety. The latter has been claimed to be especially significant in the ED, and significant efforts are being made prevent adverse events when patients are being attended to there [19,20].

The objective of this review is to determine the advantages and disadvantages of each strategy in terms of effectiveness, quickness, and safety to treat patients presenting with acute AF in the ED.

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Table 1 Levels of evidence scheme of the 'Agència d'Avaluació de Tecnologia Sanitària del Servei Català de Salut'

Level	Strength of the evidence	Type of design	Stringency conditions
I	Appropriate	Meta-analysis of controlled-randomized trial	No heterogenicity Different analysis techniques Meta-regression Meta-analysis
II	Appropriate	Large sample controlled-randomized trial	Evaluation of statistical power Multicentric Quality of the study
III	Good to regular	Small sample controlled-randomized trial	Evaluation of statistical power Multicentric Quality of the study
IV	Good to regular	Prospective controlled-non-randomized trial	Evaluation of statistical power Multicentric Quality of the study
V	Regular	Retrospective controlled-non-randomized trial	Historical control group
VI	Regular	Cohort studies	Multicentric Pairs Quality of the study
VII	Regular	Case–control studies	Multicentric Quality of the study
VIII	Poor	Noncontrolled clinical series Descriptive studies Expert committees Consensus conferences	Multicentric
IX	Poor	Anecdotes or unique cases	

Methods

A comprehensive literature search was carried out to identify all articles published between January 2000 and December 2011 that discussed rhythm control treatment of acute AF in the ED. ISI Web of Science and MEDLINE were explored for articles in English or Spanish for the keywords 'acute', 'recent-onset', or 'paroxysmal' AND 'atrial fibrillation' AND 'treatment' AND 'emergency'. Articles were included if they specifically addressed at least one of the following outcomes: (i) time to conversion, (ii) length of stay in the ED, (iii) safety, and (iv) relapses or readmissions. Bibliographic references within selected papers were also reviewed to identify additional articles.

All published original studies were considered for inclusion in the analysis. A-priori exclusion criteria were trials that enrolled patients with AF episodes of prolonged duration (> 48 h) or patients with postsurgical or post-myocardial infarction AF, secondary and unstable AF, as well as studies that lacked data on the rate of SR conversion. Clinical trials with experimental drugs or drugs not currently available at the time of publication and duplicate publications of previously published data were also excluded, as well as reviews, unpublished studies, and abstracts.

In those studies that included both AF and atrial flutter patients, only AF patients were considered. In studies with patients managed in different settings, only patients managed at the ED were considered.

A level-of-evidence scheme using an assessment tool published by the local government agency (Agencia d'Avaluació de Tecnologia Sanitària del Servei Català de Salut) [21] was used to categorize the trials included in the analysis according to their methodological rigor and to help make valid conclusions (Table 1). According to this scheme, a further selection was carried out, and we included only trials considered good or regular and excluded studies classified as methodologically poor. As a consequence, only controlled trials were included.

The following variables were extracted from each study, if available: number of patients included, agent(s) studied, type and level of evidence of the article, rate of SR conversion, time to conversion, discharge rate, length of stay in the ED, adverse events, embolic complications, and relapses.

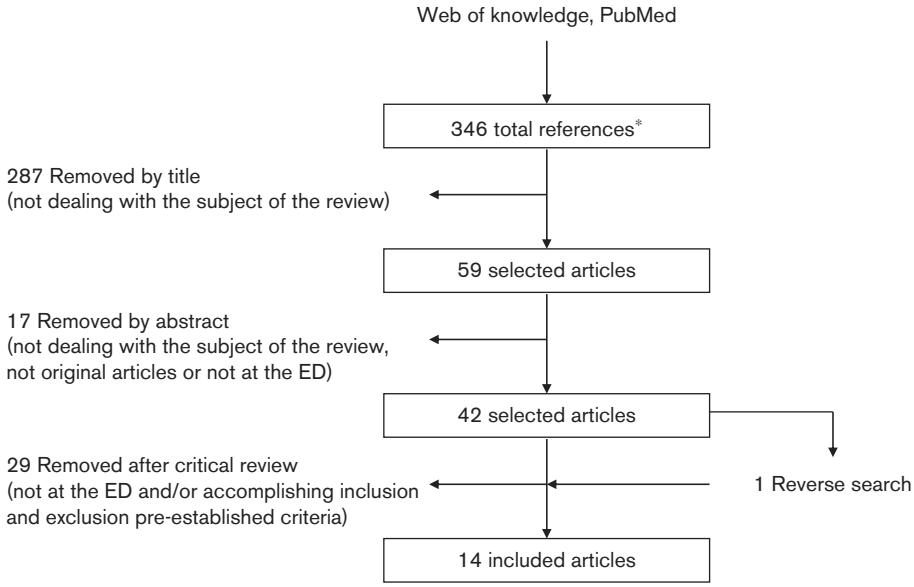
All studies were reviewed independently for eligibility and data abstraction by two investigators. Differences were resolved by discussion until a consensus was reached. Data were abstracted twice and checked for accuracy after data entry.

Results

In total, 346 potentially relevant articles were identified. Forty-two articles were selected manually for further review on the basis of the relevance of the abstract. Of these, 13 articles fulfilled the inclusion criteria and were assessed for quality. Another article was included after analyzing the references of the initially selected articles (Fig. 1). Of the 14 finally identified eligible studies, eight were prospective controlled randomized trials (levels II and III), four were prospective controlled nonrandomized trials (level IV), and two were retrospective controlled nonrandomized trials (level V).

Data abstracted from the trials selected are provided in detail in Table 2. These trials were conducted in eight countries. In total, 2765 patients were enrolled (median 156.5, range 46–376). The median quality score was III.

Fig. 1



Flow chart showing the inclusion process.

Conversion to sinus rhythm and time to conversion

All papers analyzed conversion rates.

Direct current cardioversion assessment

DCC was addressed specifically in five articles. Decker *et al.* [22] randomized patients to DCC at the ED or routine admission care, but treatment at admission was not specified. All patients received rate control drugs, and in the ED group, DCC was performed if AF persisted at 6 h (51% patients). The overall conversion rate was superior in the ED group, although the difference was not statistically significant.

In four articles, DCC was compared with PhC or with a conservative option. In all of them, DCC was significantly more effective than the other options to restore SR: in the first article, Cristoni *et al.* [23], in a nonrandomized study, compared a DCC pathway with a PhC pathway prospectively. In the DCC pathway, DCC was used as a first strategy only in patients with AF of more than 6 h at presentation, patients who had taken a previous antiarrhythmic drug, or patients who did not restore SR after 6 h of antiarrhythmic drug administration. Drugs used were amiodarone or class IC drugs in the absence of heart disease. SR restoration was higher following the DCC pathway (93 vs. 51%, $P < 0.001$). In the second study, Bellone *et al.* [24] randomly compared DCC with intravenous propafenone. SR restoration rates were significantly superior with DCC (89.3 and 73.8%, respectively, $P = 0.02$). In the third study, Vinson *et al.* [25], in an observational trial, compared four treatment pathways: spontaneous cardioversion, cardioversion attempted electrically or pharmacologically, home observation ('wait-and-see' approach), and cardioversion contraindicated. SR conversion was higher with DCC as a first option (96.9%), followed at a distance by the 'wait-and-see' approach (69%) and PhC (60%). Finally, in the fourth paper, Dankner *et al.* [26], in a retrospective study, compared DCC, PhC (propafenone, procainamide, or amiodarone), and rate control (digoxin, verapamil, or beta-blockers) with spontaneous conversion ('wait and see'). The selection of the drug was at the discretion of the attending physician. The rates of SR restoration were 78.2, 59.2, and 37.9%, respectively ($P < 0.001$).

Pharmacological cardioversion assessment

In terms of PhC, the drugs studied in the selected articles were amiodarone, ibutilide, class IC drugs (flecainide and propafenone), and magnesium. Studies comparing PhC with DCC have already been described in the previous section.

Amiodarone was analyzed specifically in four articles. Martínez-Marcos *et al.* [27], in a prospective randomized study, compared it with class IC drugs. Hirschl *et al.* [28] and Conti *et al.* [29] made the same comparison in nonrandomized studies. In all three studies, class IC drugs showed a higher conversion rate and a shorter time to conversion than amiodarone, although in the study by Conti *et al.*, the overall rate of conversion at 24 h was similar in all drugs. In the study by Hirschl *et al.*, amiodarone was also compared with ibutilide, which

Table 2 Data abstracted from articles included

References, country	*N* centers/ *N* patients[a]	AF population	Study design/ level of evidence	Treatment studied	SR conversion rate/time to conversion	Rate of discharge/ length of stay	Recurrences and readmissions	Adverse events / embolic complications	Main limitations
Cristoni *et al.* [23], Italy	2/322	Stable AF <48 h High risk of embolism and acute clinical conditions excluded	Prospective, controlled, not randomized IV	DCC vs. PhC (DCC cohort: PhC was attempted first if AF duration <6 h)	Discharge in SR higher in DCC cohort (93 vs. 51%, $P<0.001$)	Similar LS Rate of discharge higher DCC cohort (94 vs. 56%, $P<0.001$)		Similar low rate of short-term AE (2–3%, not serious) Two long-term EC after amiodarone (30 days) and DCC (4 months)	More class IC drugs used in the PhC cohort Indirect follow-up Results in the PhC group are not differentiated by drugs used
Hirschl *et al.* [28], Austria	1/376	Stable AF <48 h ICC, stroke, or SCA excluded	Prospective, controlled, not randomized IV	Flecainide vs. magnesium vs. ibutilide vs. amiodarone vs. digoxin vs. diltiazem vs. digoxin + diltiazem	Primary response (6 h): higher with flecainide (95%, $P=0.014$), followed by ibutilide (76%) Amiodarone: low primary response (36%) but high secondary (24 h) and overall response (57%) Digoxin and diltiazem: low primary response separately but high together (69%)		No recurrences at 24 h	Lower AE with digoxin and higher with amiodarone (1 vs. 6%, $P=$NS)	Small number of enrolled patients in each group
Bellone *et al.* [24], Italy	1/247	Stable AF <48 h >75 years, high risk of embolism and acute clinical conditions excluded	Prospective, randomized (large sample) II	DCC vs. IV propafenone	SR conversion rate higher with DCC (89.3 vs. 73.8%, $P=0.02$)	Shorter LS with DCC (180 min vs. 420 min, $P<0.001$)	Similar rate of recurrence (26.3–28.2%) at 2 months	Similar low rate of AE (4.8% in propafenone group vs. 0.8% in DCC group, $P=$NS)	
Vinson *et al.* [25], USA	3/191	AF<48 h	Prospective, controlled, not randomized IV	Spontaneous cardioversion vs. DCC or PhC attempted vs. home observation 48 h ('wait-and-see' approach) vs. cardioversion contraindicated	SR conversion: higher with DCC as a first option (96.9%) PhC 60% 'Wait-and-see' 69%	Rate of discharge 94% in the 'wait-and-see' approach, and 91% with attempted cardioversion		Low rate of AE (2.9–2.6% in DCC group), all resolved in the ED Two EC at 30 days (one in PhC, one in cardioversion contraindicated group)	Different size of groups Some results are not differentiated by AF/flutter
Conti *et al.* [29], Italy	1/341	Stable AF<48 h NYHA>II or complications excluded	Prospective, controlled, not randomized IV	IV flecainide vs. IV propafenone vs. IV amiodarone	SR conversion rate at 6 h higher with flecainide (72.1%) and propafenone (54.5%) vs. amiodarone (29.7%, $P<0.001$) Overall SR conversion at 24 h high and similar in all groups (overall 87%) Time to conversion shorter with flecainide (178 min) and propafenone (292 min) vs. amiodarone (472 min, $P<0.001$)	Shorter LS with flecainide (8.9 h) and propafenone (11 h) vs. amiodarone (26.1 h, $P=0.001$)		Similar rate of AE (1.7%), one requiring DCC (propafenone)	Not randomized Different size of groups
Chu *et al.* [33], Australia	1/48	Stable AF <48 h and rate >100 bpm Wide QRS, hypotension, pulmonary edema, and MI excluded	Prospective, randomized (small sample),	Magnesium sulfate vs. placebo	No differences in heart rate control or in SR conversion				Convenience sample Basal differences between

			double-blinded III						groups Low dose of magnesium sulfate Other therapies allowed
Dankner *et al.* [26], Israel	1/374	Stable AF, patients eligible for CV	Retrospective, controlled, not randomized V	DCC vs. PhC vs. 'wait and see'	SR conversion rate higher with DCC (78.2 vs. 59.2% with PhC and 37.9 with 'wait-and-see', $P<0.001$)	Discharge rate higher with DCC (52.9%) and PhC (47.9%) vs. 'wait-and-see' (32.1%, $P<0.001$)	5.5% recurrences at 7 days, none in the DCC group	3.4% probably related complications at 14 days No EC at 14 days	Results in the PhC group are not differentiated by drugs used
Decker *et al.* [22], USA	1/153	Stable AF <48 h Previous MI, ACS, HF or stroke excluded Patients requiring admission excluded	Prospective, randomized (small sample) III	Rate control±DCC at ED vs. routine in-patient care	SR conversion higher in the ED group (85 vs. 73%, P=NS)	LS shorter in the ED group (12.6 vs. 50.1 h, $P<0.001$)	Similar rate of recurrence (10–11%)	4% AE requiring admission in the ED group	Routine in-patient care poorly described
Viktorsdottir *et al.* [31], Iceland	1/46	AF<7 days, nonfasting Previous antiarrhythmic drugs, decreased LVEF, long QT or low ventricular response excluded	Retrospective, controlled, not randomized V	Ibutilide vs. rate control	SR conversion rate higher with ibutilide (64 vs. 29%, $P<0.005$, all in <1 h)	All converted patients discharged		No AE	Small sample size Basal differences between groups
Thomas *et al.* [34], Australia	1/140	Recent-onset, symptomatic AF Previous amiodarone or sotalol, asthma, HF, hepatitis, pulmonary fibrosis, bradycardia, sick sinus syndrome excluded	Prospective, randomized (large sample) II	Sotalol vs. amiodarone vs. digoxin±DCC	Similar SR conversion rates		Similar rate of early recurrence (6–7% at 24 h)	8% AE, more hypotension with amiodarone ($P=0.035$) One EC in the digoxin group (index visit)	
Cybulski *et al.* [30], Poland	1/160	Stable AF<24 h	Prospective, randomized (small sample) III	Amiodarone vs. Mg sulfate	SR conversion rate superior with amiodarone at 8 h (50 vs. 26%, $P<0.05$) and at 20 h (83 vs. 44%, $P<0.0001$)			1.8% AE in the amiodarone group	
Madonia *et al.* [32], Italy	1/97	AF <48 h Previous antiarrhythmic drugs, >75 years, HF, MI, thyroid, renal or hepatic dysfunction, or conduction disorders excluded	Prospective, randomized (small sample) III	Intravenous vs. oral propafenone	Higher rate of SR conversion with intravenous propafenone at 1 and 3 h ($P<0.001$) Similar SR conversion rate at 6 h, 12 h and 24 h Overall conversion rate 83.3% at 12 h and 98.9% at 24 h			No patient required treatment suspension	
Joseph and Ward [35], Australia	3/120	AF<24 h Previous antiarrhythmic drugs, asthma, HF, thyroid disease or wide QRS excluded	Prospective, randomized (large sample) II	Amiodarone vs. sotalol vs. digoxin ±DCC	Higher SR conversion rate with amiodarone and sotalol vs. digoxin both with DCC (94 and 95% vs. 78%, $P<0.01$) or without (77 and 88% vs. 58%, $P<0.01$ of sotalol vs. digoxin) Shorter time to conversion with sotalol (13 h) and amiodarone (18.1 h) vs. digoxin (26.9h, $P>0.01$ and $P<0.05$, respectively)			No serious proarrhythmia 6.3% AE in the active therapy group, 19.3% in digoxin group (mostly HF) 1 EC digoxin group (48 h)	
Martinez-Marcos *et al.* [27], Spain	1/150	AF<48 h HF, low LVEF, ACS, conduction disturbances, hypotension, bradycardia, thyroid, or hepatic	Prospective, randomized (large sample), single blind II	Flecainide vs. propafenone vs. amiodarone	SR conversion rate higher with flecainide (90% at 12 h vs. 72% with propafenone –$P=0.022$, and 64% with amiodarone – $P=0.002$) Conversion time lower with flecainide (25 min) and propafenone (30 min)			11% AE, similar between groups and mostly transient One EC in the amiodarone	

Table 2 (*continued*)

References, country	*N* centers/ *N* patients[a]	AF population	Study design/ level of evidence	Treatment studied	SR conversion rate/time to conversion	Rate of discharge/ length of stay	Recurrences and readmissions	Adverse events / embolic complications	Main limitations
		dysfunction, or pulmonary fibrosis excluded			with respect to amiodarone (333 min), $P<0.001$			group (index visit)	

ACS, acute coronary syndrome; AE, adverse event; CV, cardioversion; DCC, direct current cardioversion; EC, embolic complication; ED, emergency department; HF, heart failure; LS, length of stay; LVEF, left ventricular ejection fraction; m, months; MI, myocardial infarction; NS, not significant; NYHA, New York Heart Association; PhC, pharmacologic cardioversion; SR, sinus rhythm.
[a]Patients included twice are counted separately.

showed a conversion rate lower than that of IC drugs (76 vs. 95%, $P = 0.014$) but higher than that of amiodarone (36%). Cybulski *et al.* [30] reported a superior SR restoration rate with amiodarone compared with magnesium (50 vs. 26% at 8 h, $P < 0.05$, and 83 vs. 44% at 20 h, $P < 0.0001$).

In another study, Viktorsdottir *et al.* [31] retrospectively compared ibutilide with rate control and showed a higher conversion rate with ibutilide (64 vs. 29%, $P < 0.005$) with a very short time to conversion (all of them in <1 h).

Propafenone was studied as a single drug in one study [32] in which oral administration was compared with intravenous administration, with similar and high conversion rates but shorter time to conversion with the intravenous form.

Only one study [33] compared magnesium with placebo. The conversion rate at 2 h was similar with the two options.

Combined direct current cardioversion and pharmacological cardioversion assessment

Thomas *et al.* [34] and Joseph and Ward [35], in two separate prospective randomized studies, compared the efficacy of amiodarone, sotalol, and digoxin, both alone and in combination with DCC if SR had not been restored at 48 h. In Thomas' study, SR restoration at 12 h was poor with all drugs (51, 44, and 50% respectively, *P* not statistically significant) but combined therapy with DCC after 12 h resulted in a high conversion rate (94, 95, and 98%, respectively, *P* not statistically significant). Joseph and colleagues found that the conversion rate at 24 and 48 h was higher with sotalol (80% at 24 h vs. 69% amiodarone and 50% digoxin, $P < 0.05$ vs. digoxin), which also showed a shorter time to conversion. After DCC, more patients in the sotalol and the amiodarone group were in SR with respect to patients in the digoxin group (95 and 94% vs. 78%, $P < 0.01$).

Length of stay and discharge rate

Only five trials analyzed the discharge rate and four articles analyzed the length of stay. Among the three trials in which DCC was analyzed as a first option [23,25,26], two of them reported a very high discharge rate (94 and 91%). In one of them [26], the discharge rate with DCC was similar to that with PhC, in another it was similar to that in the 'wait-and-see' option [25], and the third one [23] reported a higher discharge rate with DCC compared with PhC. In terms of length of stay, DCC involved a short one in the three trials in which it was analyzed [22–24], and in two of them, DCC also showed a shorter length of stay compared with PhC [22,24].

In the only study in which it was tested [31], ibutilide showed a high rate of discharge (100%). Conti *et al.* [29] reported a longer length of stay with amiodarone compared with class IC drugs.

In the only study that analyzed the 'wait-and-see' option with home observation, the discharge rate was high (94%) and similar to that obtained with DCC [25].

Adverse events

Thirteen of the 14 trials analyzed adverse events and/or complications. Adverse events were in general rare, transient, and not serious in all therapeutic options. The most frequent ones were transient hypotension, sedation-related hypoxia, and rhythm disturbances (bradycardia, QTc, or QRS prolongation, ventricular tachycardia, torsade de pointes, and atrioventricular block). Serious adverse events were infrequent and almost always resolved at the ED. No death was reported. The only significant difference between different therapeutic options was described by Thomas *et al.* [34], who found a higher rate of hypotension with amiodarone compared with sotalol and digoxin.

The follow-up time was very heterogeneous (from 24 h to 6 months). There were only five early embolic complications (0.1% of all patients included) [25,27,31,35]. Two of them corresponded to patients treated with a rhythm control strategy: DCC (one patient) and PhC (one patient). The other three occurred in patients of the rate control group while being in AF; thus, the relationship with cardioversion was nonexistent. Two late embolic events in patients who achieved cardioversion occurred at 30 days and 4 months [23]; thus, they were probably unrelated to the previous cardioversion.

Readmissions and recurrences

Recurrences and readmissions related to AF were analyzed in five articles [22,24,26,28,34]. The results varied from 0% at 2 h to 26–28% at 2 months in the readmissions. There were no significant differences in AF recurrence among the different therapeutic options.

Discussion

This review synthesizes the different options studied to treat acute AF in the ED. The lack of prospective randomized studies on the subject led the authors to search evidence published in less qualified studies to provide more complete information. In spite of the variability among studies in terms of the design and therapeutic options, some conclusions can be drawn.

First, this review confirms that the management of acute AF in the ED is feasible, with results comparable to those obtained in other settings, both in terms of effectiveness and safety. In the vast majority of the studies presented, SR conversion and discharge rates were high, especially with DCC, and adverse events were transient and infrequent irrespective of the method used. Only two embolic complications could be directly attributed to cardioversion at the ED. There is very little evidence on the rate of embolic complications after cardioversion of recent-onset AF, but the results obtained to date are in accordance with our conclusion, namely, that the risk of embolic complications under these circumstances is low and that it is independent of the means of achieving cardioversion [36]. This fact should reassure emergency physicians and encourage them to carry out cardioversion as soon as possible, with DCC as the first-choice option, to avoid the need for oral anticoagulation related to cardioversion and subsequently delay of the procedure.

Another issue to highlight is that AF management at the ED allowed a high rate of discharge, thus avoiding many admissions, which could contribute to ED overcrowding. Few admissions imply a reduction of costs and to have more available beds, which are very interesting issues for the ED concerns. Other authors have already reported that AF *per se* does not justify admission [4,15]. In addition, the use of an observation unit in the ED to avoid unnecessary admissions of AF patients has already been described with good results [37].

With respect to the different therapeutic options attempted, DCC was the most effective one, both in terms of the SR conversion rate and the length of stay. These results are in agreement with those of previous studies, some of them carried out in other settings. Although DCC requires sedation and 6 h of fasting, adverse events related to sedation were transient and rarely serious, and the overall length of stay was not prolonged by the need for fasting.

Class IC drugs usually had lower conversion rates compared with DCC, and their use implied a longer length of stay than in DCC. Besides, studies in which these drugs were used were very selective in inclusion criteria, as they excluded patients with other comorbidities, especially heart disease. This implies that patients included in these studies are not wholly representative of real ED patients with AF. Nevertheless, in the population studied, adverse events were infrequent and results with IC drugs in terms of effectiveness and efficiency were considerably better that those obtained with amiodarone. These results are in agreement with those obtained by Alboni *et al.* [38], who reported a very high rate of conversion (94%) with few side-effects and a low rate of recurrences in patients who, having received flecainide or propafenone previously in an in-hospital setting with good results, self-administered these drugs as outpatients.

In this review, amiodarone was a scarcely effective drug in restoring SR in the short term, and it was not free of side-effects. Although amiodarone is superior to digoxin or placebo in SR restoration and is similar to other options in the long term, the long time to conversion implies a long time to discharge, which can hinder the smooth running of the ED.

Interestingly, combined options were assessed, satisfactorily. Some studies did not evaluate a single therapeutic option but evaluated a combined protocol with an antiarrhythmic drug and DCC with good results. This option provides the opportunity of cardioversion to some patients who would otherwise have to wait because of the fasting requirement and ensures a good final and prompt result with DCC if the first option has not been effective in a preset period of time.

Another interesting option is the 'wait-and-see approach' with home observation. Although only one study had analyzed this option, the conversion rate was very high and the admission rate was similar to that in other therapeutic options. There are several limitations to this option: the number of patients included was small, rate control drugs were also required, time to conversion was not specified, and a second admission was required. Still, it remains a very reasonable option to be considered in stable young patients with AF of less than 24-h duration. In fact, some guidelines include the possibility of discharging AF patients and readmitting them before 48 h to perform DCC if they are still in AF [39].

As mentioned initially, one of the main limitations of this review is the variability of studies included. Although all of them were controlled trials, the options analyzed were multiple. Moreover, some other treatment options were not even mentioned because they were only analyzed in descriptive trials. This is the case in the study by Stiell *et al.* [40], who showed a high SR conversion and a very short length of stay on applying a protocol of procainamide administration plus DCC, if procainamide was not effective, in a series 660 patients with AF or flutter. Another limitation is that some new therapeutic options, such as vernakalant [41], are not included because of the lack of original studies on it in the ED when the review was written. Finally, some studies in which the setting was not recorded and were rejected because they were carried out by cardiologists and there was no mention of the ED could actually have taken place in an ED.

Conclusion

AF cardioversion is feasible in the ED. However, as frequently occurs, decision-making in ED is carried out with some uncertainty because ideal randomized clinical trials are not available for real-world problems [42]. This review exemplifies this assertion. On the basis of published data, nowadays, the best option is probably DCC with the possibility of considering a previous antiarrhythmic drug. Amiodarone alone should almost always be relegated to a second place. Finally, home observation in stable patients with AF of a short duration is an acceptable strategy. Clearly, newer therapeutic options have to be tested in this setting, and more large, prospective, randomized trials are required to confirm the conclusions arrived at using the classic strategies.

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Conflicts of interest

There are no conflicts of interest.

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