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The introduction of a new service for direct current cardioversion (DCCV) for atrial fibrillation in a district general hospital

JENNIE WALSH, DAVID A SANDLER, CHARLIE ELLIOT, ANDY CHALLANDS

Abstract

The timing and effectiveness of a new protocol for organising direct current cardioversion (DCCV) for patients with atrial fibrillation (AF) was compared with the existing system in a medium-sized district general hospital in the United Kingdom. The new protocol comprised a monthly dedicated DCCV list in the operating theatres, with an anaesthetist and an Operating Department Assistant providing anaesthesia, and cardiology medical staff performing the cardioversion. The last 35 consecutive patients undergoing DCCV for AF before the new protocol was introduced were compared with the first 35 patients having DCCV under the new protocol.

The time to perform 35 consecutive cardioversions was reduced from 32 months to 10 months. The new system resulted in no cancellations for administrative reasons and only one patient for a clinical reason. Sinus rhythm (SR) was restored in 60% cases under the new protocol (double the success rate before the new protocol) and 76% patients discharged in SR under the new protocol, remained in SR at clinic follow-up.

A simple change in the method of delivering a clinical service has resulted in an improvement in both the administration and clinical outcome for patients. Such changes, requiring co-operation between anaesthetic and cardiology departments, could be implemented widely for the benefit of many patients.

Key words: atrial fibrillation, direct current cardioversion, service delivery.

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Directorate of Medicine, Chesterfield & North Derbyshire Royal Hospital, Calow, Chesterfield, S44 5BL.
Jennie Walsh, Senior House Officer
David A Sandler, Consultant Physician and Cardiologist
Charlie Elliot, Senior House Officer
Andy Challands, Clinical Audit & Research Co-ordinator
Correspondence to: Dr DA Sandler
(email david.sandler@chesterfieldroyal.nhs.uk)

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Introduction

Chronic atrial fibrillation (AF) is a common condition and its prevalence increases with age, affecting up to one in 10 people over the age of 75.[1] Treatment strategies include either control of the ventricular rate (rate control) or restoration of sinus rhythm (SR) (rhythm control). It is argued that restoration of SR is preferred over rate control.[2,3] Benefits include symptom improvement and increased exercise tolerance, as well as a reduction in thromboembolic risk. In addition, it avoids the added complications of long-term anti-arrhythmic therapy and anticoagulation in patients who remain in AF.

Direct current cardioversion (DCCV) involves a general anaesthetic, during which a synchronised DC counter shock is applied to the heart through defibrillator pads placed on the patient's chest in the same position as for emergency defibrillation. The shock is synchronised to discharge on the R wave of the QRS complex on the electrocardiogram (ECG), and so avoids conversion of the rhythm to ventricular fibrillation. If the first shock of 50J fails to restore SR on the ECG, the energy is increased in increments until 360J.

DCCV is a cost-effective approach to the management of AF,[4] although AF frequently recurs within the first year of a successful DCCV.[5] In such circumstances patients may require further cardioversion and/or anti-arrhythmic therapy to restore and maintain SR, or long-term anti-arrhythmic therapy for rate control if AF persists. The likely success of DCCV depends on the duration of AF: longer duration makes the restoration of SR less likely,[6] as does the presence of a structural abnormality within the heart, such as rheumatic valve disease, left ventricular dysfunction and an enlarged left atrium.[7] DCCV is not without risk. It is associated with a risk of thrombo-embolism[8] and, more rarely, prolonged asystole or bradycardia.[3]

This paper describes what we believe to be an innovative approach to the organisation of elective cardioversion of AF patients within a 650-bed district general hospital.

Methods

Traditionally, cardioversion was arranged on an ad hoc basis for individual patients. The referring doctor booked a bed on the coronary care unit (CCU), arranged an anaesthetist and then performed the cardioversion. The unpredictable nature of bed availability on the CCU meant these arrangements often failed, resulting in the cancellation of the procedure.

In response to concerns about quality of care and inefficient use of resources, the service was re-organised and a protocol for car-

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Figure 1. The sample request form for DCCV

Chesterfield & North Derbyshire Royal Hospital
CARDIOVERSION REQUEST FORM

Patient identity label

Consultant:
Signature:

Date of request:

PLEASE ANSWER ALL THESE QUESTIONS	YES	NO	DETAILS/COMMENTS
Is AF of less than 12 months duration?			Date AF started?
Is the AF persistent rather than paroxysmal?			
Has patient been on warfarin for at least 3 weeks?			
Has the INR been therapeutic (2–3)?			
Cause of AF thought to be?:			
Present treatment for AF?:			
ON ECHOCARDIOGRAPHY			Date of ECHO?
Is left atrium less than 50 mm?			
Is there no evidence of rheumatic valve disease?			
Is left ventricular function good?			
Is thyroid function normal?			TSH value? Date?
Have you made plans for a follow-up appointment for the patient after the attempt at cardioversion?			Appointment?

IF YOU ARE ABLE TO ANSWER YES TO ALL THE ABOVE, SEND THE NOTES AND REQUEST FORM TO CARDIOLOGY SECRETARY MARKED "CARDIOVERSION REQUEST" TO ARRANGE A DATE FOR THE CARDIOVERSION ATTEMPT.

dioversion was introduced. For one morning each month, a theatre anaesthetic room, an anaesthetist and an Operating Department Assistant are allocated for DCCVs. Patients are booked as day case procedures and cardiologists perform up to six DCCVs. Patient selection and preparation is standardised as follows.

- To be eligible for DCCV, the patient should have been in AF for less than 12 months and adequately anticoagulated with warfarin (target International Normalised Ratio [INR] of 2.5) for at least three weeks before the procedure. Echocardiography should exclude rheumatic heart disease and show good left ventricular function and a left atrial diameter of less than 50 mm. Thyroid function should be normal.
- The referring doctor submits a standardised request form (see figure 1) for all eligible patients to the cardiology office and the patient is placed on the DCCV waiting list. The referring doctor must arrange for a follow-up appointment after the DCCV, as a condition of the request being accepted.
- About three weeks before their DCCV, patients are sent a letter explaining arrangements for the procedure, enclosing an information leaflet and pre-completed laboratory and ECG request forms.
- On the day before the procedure, the patient attends the hospital for a series of pre-admission tests to confirm eligibility (ECG, INR, blood tests including a digoxin level to exclude toxicity). The results are reviewed by the cardiology Senior House Officer and the DCCV is cancelled for any patients who are no longer eligible. Patients are informed of the cancellation by phone that afternoon.

Table 1. Reasons for cancellation of DCCV

	Pre-protocol (n=35)	Protocol (n=35)
No bed on CCU	12	
No anaesthetist	2	
Low INR	4	2
Low potassium	2	
Hypertension	1	
Chest infection	1	
Patient holiday	1	

- On the morning of the DCCV, the patient is reviewed and consent is obtained. The cardioversion is performed under general anaesthesia, with sequential shocks of 50, 100, 200, and two shocks of 360 joules if necessary. If the fifth shock does not restore SR, the procedure is deemed a failure to convert. The patient is reviewed and allowed home after an ECG.

An audit was undertaken to compare the effectiveness of the current arrangements for cardioversion against the previous system. The sample comprised two consecutive groups of patients. One group had their cardioversion under the old system and the other group had their cardioversion under the new protocol. The audit measured the time from onset of AF to attempted DCCV; the time from decision to cardiovert to DCCV; the number of cancellations and the reason for cancellation; the number of successful cardioversions (i.e. discharged in SR) and the number of patients still in SR at first out-patient follow-up.

The cardioversion request form was used to collect data on the protocol group. Comparative data was collected by a retrospective review of the healthcare records of the pre-protocol group.

Results

Thirty-five patients (80% male; mean age 62 [26–79]) were treated under the protocol and 35 patients (94% male; mean age 65 [48–79]) were treated pre-protocol. The pre-protocol DCCVs were undertaken between February 1998 and October 2000. The protocol procedures were performed between August 2000 and May 2001.

Seventeen patients (47%) in the pre-protocol group would not have been eligible for DCCV under the protocol. Reasons for ineligibility include a failure to document thyroid function results, unsuitable echocardiogram findings or too-long a duration of AF. For three patients (8%) in the protocol group, eligibility was equivocal because the duration of AF was either unknown or exceeded one year. After discussion with a consultant cardiologist, it was decided that there were no unfavourable echocardiogram findings and all three of these patients proceeded to an attempt at cardioversion.

The number of patients who had cardioversion cancelled fell significantly from 16 patients in the pre-protocol group to one patient in the protocol group (p=0.0001, CHI squared test). The 16 patients in the pre-protocol group included three patients who were cancelled twice and two patients who were cancelled

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Table 2. Time from onset of AF and request for DCCV to DCCV being undertaken

Time (days)	Pre-protocol (n=35)	Protocol (n=35)	p value
1. Onset of AF to DCCV			p=0.57
- mean	253	219	
- standard deviation	138	85	
- median	237	202	
- range	34–664	117–422	
2. Request to DCCV			p=0.002
- mean	113	69	
- standard deviation	84	29	
- median	100	68	
- range	6–398	13–117	

Table 3. Restoration of sinus rhythm after DCCV

	Pre-protocol (n=35)	Protocol (n=35)	p value
Outcome	n (%)	n (%)	p=0.03
Discharged in sinus rhythm	10 (30)	21 (60)	
Remained in sinus rhythm at follow-up	8 (80)	16 (76)	

three times. In the protocol group only one patient was cancelled, but that patient was cancelled twice. The reasons for cancellation are shown in table 1.

In total, 68 (97%) of the 70 patients studied proceeded to cardioversion. Two patients in the pre-protocol group decided (after a cancellation) not to proceed. Table 2 shows the time from onset of AF to DCCV and the time from request for DCCV (by the referring doctor) to DCCV.

Table 3 shows the percentage of cardioverted patients who achieved SR on the morning of DCCV, and those who were still in SR at the time of follow-up. The mean time to first follow-up was 83 days. Only three patients did not attend for follow-up – two pre-protocol patients and one protocol patient.

Discussion

The aim of the audit was to determine if a formalised protocol for patient selection and preparation, and the practice of DCCV, utilising a dedicated monthly theatre list, had improved patient outcomes.

The audit showed that cancellations for organisational reasons have been eliminated under the protocol. This has major implications in terms of patient outcomes (cancellations inevitably delay cardioversion), quality of care for the patient and the efficient use of resources.

The introduction of the protocol led to a significant reduction in the time from referral to cardioversion. Evidence suggests that the shorter the duration of AF, the more likely the cardioversion will be successful in restoring SR. Although the audit showed a significant improvement in the proportion of patients discharged in SR and the proportion of patients in whom SR was maintained at follow-up, the time from onset of AF to cardioversion is still a matter of concern. This could be due to delays in referral to the hospital, failure to achieve adequate anticoagulation, long waiting times for echocardiography, or limited awareness amongst referring doctors in the early days of a new system. We plan to investigate this further as even earlier cardioversion will improve outcomes further.

The audit confirms that this innovative method of service delivery for elective DCCV for AF is both clinically effective and, presumably, cost-effective. It could easily be implemented in other hospitals.

Key messages

- Restoration of sinus rhythm is often preferred over control of the ventricular rate in the treatment of atrial fibrillation
- Direct current cardioversion (DCCV) is a cost-effective method of restoring rhythm control
- A formalised protocol for patient selection and preparation for DCCV, utilising a dedicated monthly theatre list, improved patient outcome. Waiting time was reduced, less procedures were cancelled, more patients were discharged in sinus rhythm and remained in sinus rhythm at follow-up

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