Optimal Initial Energy for Transthoracic Biphasic Shock Cardioversion of Atrial Fibrillation

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CHAN ET AL.: ***Optimal Initial Energy for Transthoracic Biphasic Shock Cardioversion of Atrial Fibrillation.*** ***Background and Objectives:*** *Recent studies have shown that biphasic shocks (BS) are more effective and require less energy than monophasic shocks (MS) in transthoracic cardioversion (TCV) of atrial fibrillation (AF). The recommended initial shock energy, using MS, is 200J for AF. This study aims to test the optimal initial energy for TCV of AF using BS.* ***Methods:*** *Patients required TCV for AF from June 1, 2001 to June 30, 2002 were enrolled. Patients with persistent AF >48 hours received therapeutic anticoagulation (INR 1.5-2.5) for at least 3 weeks before TCV. Patients with recent onset AF <48 hours were cardioverted without anticoagulation. BS was used for all patients. A step-up protocol starting with 30J, with subsequent increments to 50, 100, 150 and 200J was used. Success was defined as the presence of at least 1 clearly visible P wave within 30 seconds after the shock. Failure was defined as completion of protocol without restoration of sinus rhythm.* ***Results:*** *Twenty-seven patients (16 men and 11 women, mean age 63.0±13.7 years) were recruited. Thirteen had persistent AF and 14 had recent onset AF, of which 11 occurred during cardiac procedures including cardiac electrophysiology studies, radiofrequency catheter ablation, percutaneous coronary intervention and cardiac pacing. 96.3% (26/27) were successfully cardioverted. 92.3% (24/26) were successfully cardioverted with 100J or less energy. In patients with any one of the unfavourable factors including persistent AF of duration >48 hours, left atrial (LA) size>5.0 cm, left ventricular ejection fraction (LVEF) <50% or body weight (BW) >85 kg, 86.7% (13/15) were cardioverted with 100J or less energy. With none of the unfavourable factors, 81.8% (9/11) were cardioverted with 50J or less energy. There were no TCV related complications.* ***Conclusions:*** *BS is both effective and safe for TCV of AF. For patients with any unfavourable factors of persistent AF, LA size >5.0 cm, LVEF <50% or BW >85 kg, 100J is the optimal initial energy. In the absence of these factors, a lower shock energy of 50J can be tried first. (J HK Coll Cardiol 2003;11:46-49)*

Atrial fibrillation, biphasic shock, cardioversion

摘要

背景和目的：最近的研究顯示在房顫的經胸複律方面，雙頻道電擊比單頻道電擊更有效，並且需要的能量也較小。用頻道除顫，推薦的最初電擊能量為 2000J。這項研究的目的在於測量用雙頻道經胸電擊心臟複律除顫所需的最佳初始能量。方法：自 2001 年 6 月 1 日至 2002 年 6 月 30 日所有需要經胸電擊心臟複律除顫的病人例入研究範圍。病人房顫時間大於 48 小時需要在經胸電擊心臟複律前接受至少 3 周的抗凝治療(INR 1.5-2.5)。病人房顫初發，時間小於 48 小時者不需要進行抗凝治療。所有病人進行雙頻道電擊治療。從 30J 起能量逐步累加，後來逐漸加至 50、100、150 和 200J。治療成功的標誌是在電擊後的 30 秒內至少發現 1 個清晰可見的 P 波。失敗則定義為直至治療措施結束未能恢復竇性心律。結果：總共有 27 位病人入組研究（16 位男性，11 位女性，平均年齡 63.0±13.7 歲）。13 位病人有持續性房顫，14 位病人的房顫新近發生，其中 11 位元病人是在有關心臟的診療過程中發生的，包括心臟的電生理檢查、射頻導管消融、經皮冠狀動脈介入治療和安裝人工起搏器。96.3% (26/27) 的病人成功除顫。92.3% (24/26) 的病人除顫所需的能量等於或小於 100J。病人中有下列不利因素之一時，如持續房顫時間大於 48 小時、左房 >5.0 cm、

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Received March 21, 2003; revision accepted April 2, 2003

左房射血分數 <50% 或體重 >85 kg，86.7% (13/15) 的病人除顫所需的能量仍等於或小於 100J。不出現上述不利因素時，81.8% (9/11) 的病人除顫所需的能量仍等於或小於 50J。沒有出現經胸心臟複律的相關併發症。結論：雙頻道電擊對於房顫的經胸心臟複律是安全有效的。對於持續性房顫、左房 >5.0 cm、左房射血分數 <50% 或體重 >85 kg 的病人，最佳的初始能量為 100J。無這些因素時，可以先嘗試比較低的 50J 能量。

關鍵詞：房顫　雙頻道電擊　心臟復律

Introduction

Recent studies have shown that BS are more effective and require less energy than MS in TCV of AF. Mittal et al[1] conducted a prospective randomized study with 165 patients and found that the cumulative efficacy with BS in TCV of AF was significantly greater than that with the MS. It was also achieved with 50% less delivered current in BS. Richard et al[2] showed that with the same energy level of 150J, BS is superior to MS in TCV of AF in a prospective randomized study involving 57 patients. It has also been shown that BS decreases the need for internal cardioversion for AF.[3]

According to the ACC/AHA/ESC guidelines for the management of patients with AF, the recommended initial shock energy using MS for AF is 200J.[4] However, the optimal initial energy for BS TCV of AF is unknown. This study aims to test the optimal initial energy for TCV of AF using BS.

Methods

Patients required TCV for AF from June 1, 2001 to June 30, 2002 were enrolled. Informed consent was obtained from every patient. Patients with persistent AF of duration >48 hours received therapeutic anti-coagulation to achieve an INR of 1.5-2.5 for at least 3 weeks before TCV. Patients with recent onset AF of duration <48 hours were cardioverted without anticoagulation. BS with the Zoll's M series defibrillator/monitor was used for all patients. A step-up protocol starting with 30J, with subsequent increments to 50, 100, 150 and 200J was used. All patients had TCV in coronary care unit or cardiac catheterization laboratory. Conscious sedation with Midazolam and Fentanyl was used. Standard self-adhesive defibrillation pads were placed in the anteroposterior position. The anterior pad was placed in the right parasternal area and the posterior pad was placed just below the left scapula. Success of cardioversion was defined as the presence of at least 1 clearly visible P wave within 30 seconds after the shock. Failure was defined as completion of protocol without restoration of sinus rhythm.

Data Analysis

Patient characteristics and accumulated success rates of TCV of AF were analyzed. Continuous variables are expressed as mean±1 SD.

Results

Twenty-seven patients (16 men and 11 women) with mean age of 63.0±13.7 years were recruited. Thirteen had persistent AF and 14 had recent onset AF, of which 11 occurred during cardiac procedures including electrophysiology studies, radiofrequency catheter ablation, percutaneous coronary intervention and cardiac pacing. The mean duration of persistent AF was 4.1±5.4 months (1-19 months). Five patients had ischaemic heart disease, 4 had hypertension, 2 had congestive heart failure, 2 had diabetes mellitus and 1 had valvular heart disease. Three patients were on Amiodarone, 2 were on Flecainide, one was on Sotalol, one was on betablocker and one was on Diltiazam. 96.3% (26/27) were successfully cardioverted. This single failure was in an 80-year-old lady with persistent AF, history of hypertension, ischaemic heart disease, moderate mitral regurgitation and mild aortic regurgitation. She has dilated LA, poor LVEF and a BW of 65 kg. She has been given Amiodarone before cardioversion. 92.3% (24/26) were successfully cardioverted with 100J or less energy. There were no TCV related complications. The accumulated success

rate with the step-up protocol is shown in Figure 1.

Many factors including duration of AF, BW and transthoracic impedance have been identified to influence the success rate of cardioversion.[1,5-8] In our study, persistent AF, LA size >5.0 cm, LVEF <50% and BW >85 kg are defined as unfavourable factors. With the presence of any one of the unfavourable factors, 86.7% (13/15) were cardioverted with 100J or less energy. With none of the unfavourable factors, 81.8% (9/11) were cardioverted with 50J or less energy. The accumulated success rates in patients with or without unfavourable factors are shown in Figure 2.

Discussion

BS has been shown to be more effective and require less energy than MS in TCV of AF.[1,2] For MS, the recommended initial shock energy is 200J.[4] The optimal initial energy for BS counterpart has yet to be decided. A step-up protocol with BS was used in this study to test the optimal initial energy for BS TCV of AF.

According to our study, BS is both effective and safe for TCV of AF. In general, more than 90% of patients with AF can be cardioverted with 100J or less with BS. For patients with any unfavourable factors of persistent AF of duration >48 hours, LA size >5.0 cm, LVEF <50% or BW >85 kg, 86.7% could be successfully cardioverted with 100J or less energy. 100J is the optimal initial energy for TCV of AF in this subset of patients. In the absence of these factors, 81.8% of patients could be cardioverted with 50J or less energy successfully. In this group of patients, 50J is the optimal initial energy.

There are two major limitations in this study.

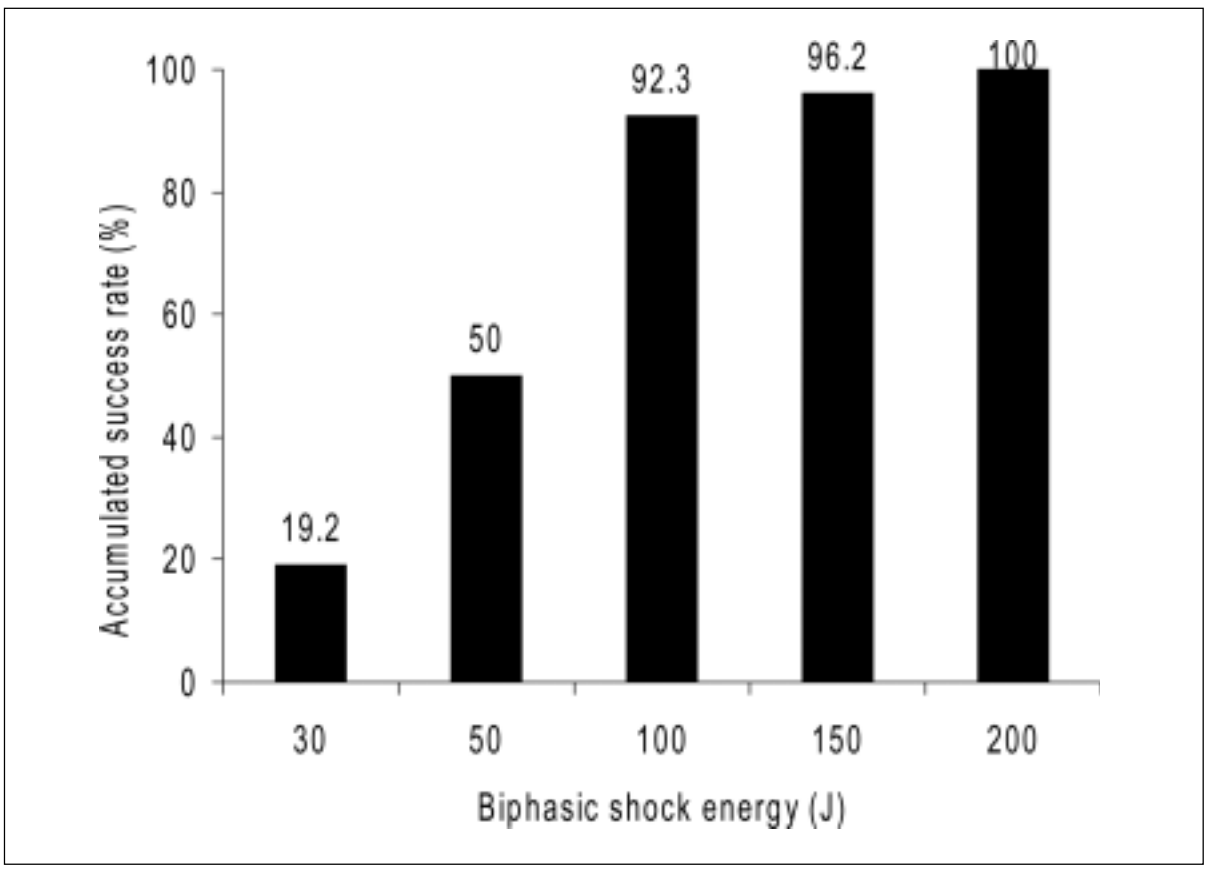

Figure 1. *Accumulated success rate of transthoracic cardioversion of AF by biphasic shock in 26 patients with successful procedure.*

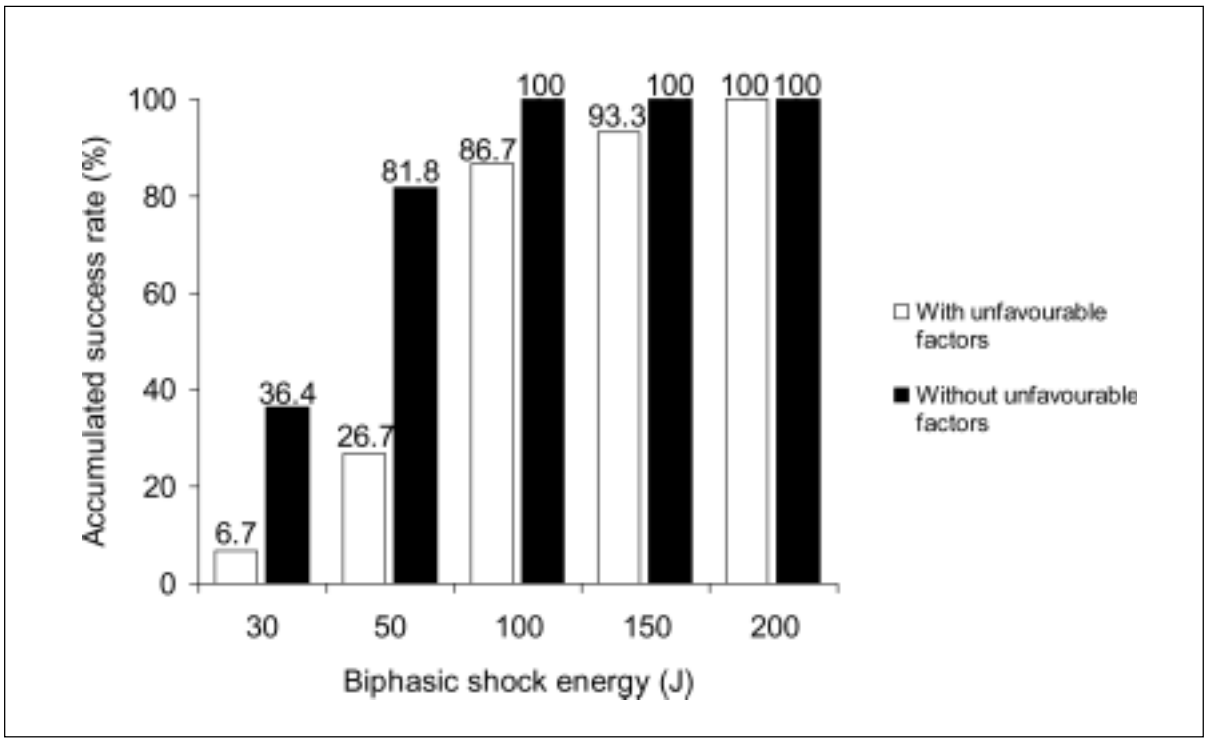

Figure 2. *Accumulated success rate of transthoracic cardioversion of AF in patients with or without unfavourable factors by biphasic shock.*

Firstly, a significant number of patients with recent onset AF developed the arrhythmia during cardiac procedures. The results of this study may not be totally applicable to non-cardiac procedure related AF. Secondly, step-up protocols underestimate true energy requirements because defibrillation success is a probabilistic phenomenon with inherent variability and more attempts are made at lower energy levels.

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