LETTER TO THE EDITOR

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Improving first shock success in patients with atrial fibrillation undergoing electrical cardioversion

We read with pleasure the before/after study by Ramirez *et al.*[1] on the implementation of the Ottawa Atrial Fibrillation (AF) Cardioversion Protocol. The improvements in effectiveness of the protocol compared with the prior non-standardized, unstructured approach were impressive: 99.2% vs. 91.8% ($P < 0.001$) for *any* success and 91.6% vs. 84.7% for *sustained* success ($P = 0.002$).

The authors were equally as successful in facilitating uptake among their colleagues: 48 of 49 cardiologists and cardiac surgeons agreed to follow the protocol and their adherence throughout the 23-month intervention phase was excellent [389 of 412 enrolled cases (94.4%) were study-eligible].[1] The strong endorsement and faithful implementation of both departments attest to the appeal of the protocol. We also find it reasonable, evidence-based, and simple to execute.

Some physicians, however, might be concerned about the relatively low incidence of first-shock success [88.4% *any* success, and even less for *sustained* success (not reported in the study)].[1] To improve first-shock success, we often advance immediately to step 3—360 J delivered across adhesive pads in the anterolateral position with manual pressure augmentation. This expedited approach requires fewer cumulative shocks and a shortened time under procedural sedation. Guidelines from the American College of Cardiology endorse the initial use of higher-energy shocks.[2] Ramirez *et al.* too readily dismiss this strategy because it is supported only by studies of monophasic—and not biphasic—devices. We see no inherent reason why higher-energy biphasic shocks wouldn't be more effective than lower-energy biphasic shocks, just as with their monophasic counterparts.[3] The higher-energy-up-front strategy may be especially advantageous in obese patients with AF, a population increasing in prevalence in many countries. A recent randomized trial found that higher energy and manual pressure augmentation were associated with significantly greater cardioversion success.[4]

We thank Ramirez *et al.* for their important contribution to the literature. We anticipate that their highly applicable findings will have an immediate and broad impact on clinical practice and will inspire further studies of improving AF cardioversion.

Conflict of interest: none declared.

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Improving first shock success in patients with atrial fibrillation undergoing electrical cardioversion: Authors' reply

We thank Vinson *et al.* for their comments and for stimulating constructive discussion. Our colleagues propose that first shock success for atrial fibrillation (AF) could be improved if Steps 1 and 2 of the Ottawa AF cardioversion protocol (OAFCP) [200 J anteroposterior (AP) shock and 200 J anterolateral (AL) shock with manual pressure augmentation (MPA)] were skipped. Instead, they propose starting with Step 3 (360 J AL shock with MPA).[1]

Considerable thought was given to the design of the OAFCP.[2–4] Our goal was to develop a protocol that would safely maximize cardioversion success for AF, while remaining generalizable, user-friendly, and palatable to physicians and surgeons. Intuitively, higher energy shocks would be expected to be more effective. However, the incremental benefits (and risks) of routinely using 360 J shocks were unknown when the protocol was developed. As detailed in our report, the mean initial shock energy at our centre prior to implementing the OAFCP was 174 ± 39 J[4]—a practice that was consistent with that seen at other centres. For instance, a European Heart Rhythm Association survey found that 64% of hospitals started with 100 J biphasic shocks.[5] Data to support using MPA for AF consisted almost exclusively of simulation experiments and case series of successful cardioversions after failed standard techniques. Given the paucity of data on 360 J shocks or MPA and given an established 88.0–91.8% cardioversion success at our centre for AF,[2,4] these manoeuvres were considered either overly aggressive or unlikely to be accepted as a quality improvement initiative if used in the first step. Thus, we were concerned about physician compliance. Also, importantly, it would have made the protocol less generalizable because defibrillators with the capacity to deliver 360 J shocks are not available at many centres.

Step 1 resulted in 88.4% cardioversion success, which improved to 96.1% with Step 2 (a 7.7% absolute increase) and to 98.7% with Step 3 (an additional 2.6% increase). Thus, although 360 J shocks were required and successful in very few instances, it may be reasonable for physicians to start with Steps 2 or 3, depending on their comfort level with MPA and/or availability of a 360 J-capable defibrillator.

The recently published randomized trial by Voskoboinik *et al.*[6] deserves thoughtful consideration. However, it was primarily a comparison of self-adhesive vs. handheld paddle electrodes and of AP vs. AA shock vectors using up to 200 J for AF in patients with obesity. Shock energies above 200 J and the use of MPA were suggested to be beneficial only in an observational substudy of 20 patients with body mass indices ≥35 kg/m^2 who failed standard 200 J shocks.