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CARDIOVERSION ELECTRIC IN PATIENTS WITH ATRIAL FIBRILLATION AND ATRIAL FLUTTER

CARDIOVERSÃO ELÉTRICA EM PACIENTES COM FIBRILAÇÃO ATRIAL E *FLUTTER* ATRIAL

CARDIOVERSIÓN ELÉCTRICA EN PACIENTES CON FABRILACIÓN ATRIAL Y FLUTTER ATRIAL

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ABSTRACT

Objective: to evaluate the positioning of the cardioverter blades electrode for performing service to electrical cardioversion in patients with atrial fibrillation (AF) and atrial flutter (AFL). ***Method***: quantitative study, cross-sectional, descriptive and analytical retrospective documentary base. Data were collected from medical records of patients, treated between January 1999 and January 2006. Data were analyzed using the Mann-Whitney, chi-square and Z tests. The research project was approved by the Research Ethics Committee, under protocol number 689. ***Results***: the sample consisted of 79 patients with AF and 33 with AFL. The global response to the ECV was 91.1%. In the AF anterolateral approach, the proportion of successful assistance was 75% as opposed to 94.9% when performed with antero-posterior approach. In the AFL with anterolateral approach, success was complete, compared to the success rate of 92.9% of cases in anteroposterior approach. In patients with AF, the success of the initial shock of 200J was higher when performed in the anteroposterior approach. ***Conclusion***: in cases of patients with AF, ECV held in anteroposterior position, they obtained greater success to anterolateral. ***Descriptors***: Atrial Fibrillation; Atrial Flutter; Electrical Cardioversion.

RESUMO

Objetivo: avaliar o posicionamento das pás-eletrodo do cardioversor durante realização de atendimento com cardioversão elétrica em pacientes com fibrilação atrial (FA) e *flutter* atrial (FlA). ***Método:*** estudo quantitativo, transversal, descritivo e analítico, de base documental, retrospectivo. Os dados foram coletados a partir dos prontuários dos pacientes, atendidos entre janeiro de 1999 e janeiro de 2006. Os dados foram analisados com uso dos testes de Mann-Whitney, qui-quadrado e Z. O projeto de pesquisa foi aprovado pelo Comitê de Ética em Pesquisa, protocolo nº. 689. ***Resultados:*** a amostra foi composta de 79 pacientes com FA e 33 com FlA. A resposta global à CVE foi de 91,1%. Na FA com abordagem anterolateral, a proporção de atendimentos com sucesso foi de 75% em contraponto com 94,9%, quando realizados com a abordagem anteroposterior. No FlA com abordagem anterolateral, o sucesso foi total, comparado ao índice de sucesso de 92,9% dos casos na abordagem anteroposterior. Nos pacientes com FA, o sucesso do choque inicial de 200J foi maior quando realizado na abordagem anteroposterior. ***Conclusão:*** nos casos de pacientes com FA, a CVE realizada na posição anteroposterior obteve sucesso superior à anterolateral. ***Descritores:*** Fibrilação Atrial; *Flutter* Atrial; Cardioversão Elétrica.

RESUMEN

Objetivo: evaluar la posición de las palas-electrodo del cardioversor durante realización de atendimiento con cardioversión eléctrica en pacientes con fibrilación atrial (FA) y *flutter* atrial (FlA). ***Método:*** estudio cuantitativo, de corte transversal, descriptivo y analítico de base documental retrospectivo. Los datos fueron recolectados a través de los prontuarios de los pacientes, atendidos entre enero de 1999 y enero de 2006. Los datos fueron analizados con uso de los tests de Mann-Whitney, chi-cuadrado y Z. El proyecto de investigación fue aprobado por el Comité de Ética en Investigación, sobre el protocolo nº. 689. ***Resultados:*** la muestra fue compuesta de 79 pacientes con FA y 33 con FlA. La respuesta global a la CVE fue de 91,1%. En la FA con enfoque antero lateral la proporción de atendimientos con suceso fue de 75% contra 94,9% cuando realizados con el enfoque anteroposterior. En FlA con enfoque antero lateral, el suceso fue total, comparado al índice de suceso de 92,9% de los casos en el enfoque anteroposterior. En los pacientes con FA, el suceso del choque inicial de 200J fue mayor cuando realizado en el enfoque anteroposterior. ***Conclusión:*** en los casos de pacientes con FA, CVE realizada en la posición anteroposterior obtuvo suceso superior a la antero lateral. ***Descriptors:*** Fibrilación Atrial; *Flutter* Atrial; Cardioversión Eléctrica.

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INTRODUCTION

Atrial fibrillation (AF) is the most common cardiac arrhythmia sustained in clinical practice. It is estimated to be responsible for approximately 33% of hospitalizations for cardiac rhythm disturbances and often associated with systemic thromboembolic events, presenting substantial morbidity, and mortality population.[1-3]

The prevalence of AF in the general population is 0.4%, but it is increasing with advancing age and affects about 0.5% of the age group 50-59 years old, doubling these values every decade and may reach almost 9.1% between 80 and 89 years old.[2] Moreover, atrial flutter (AFL) is far less common than AF, almost always associated with a structural heart disease and/or chronic obstructive pulmonary disease (COPD).[3]

The external or transthoracic electrical cardioversion (ECV) is considered the choice method in the reversal of atrial fibrillation to sinus rhythm in various situations, such as in the presence of hemodynamic instability, severe ventricular dysfunction and long AF duration.[3-4] It is an effective technique for restoring sinus rhythm, with success rates ranging from 65% to 100%[5] and depends on the clinical characteristics of samples, as well as the therapeutic success criteria established in each study.[6]

When the presence of AF or AFL do not involve risk of immediate life, electrical cardioversion should be performed using the lowest possible energy level, when 200J it is initially recommended.[7-9]

To support the analysis of thorax computed tomography scans, a study claims that the anteroposterior position, when an electrode is placed in the left scapular region and another electrode in the sternum (Lown position) or the right parasternal region (Ewy position), greater amount of electric current go through the courts, increasing the probability of success in cases of atrial arrhythmias.[4] Other studies also corroborate these results, relating less transthoracic impedance during ECV by placing the blades in anteroposterior region.[10-13]

One study showed better results when the blades of the electric cardioverter were used in the anterolateral position[14]. However, other studies did not show any significant advantage when a benchmarking technique over another one with respect to success rate and the amount of energy used.[7,10,15]

Therefore, there is a divergence in the literature with regard to cases of AF and AFL attended by ECV regarding the positioning of blades that could offer better results.

This study aims to:

- Evaluate the placement of the blades electrode cardioverter for performing service to electrical cardioversion (ECV) in patients with atrial fibrillation (AF) and atrial flutter (AFL).

METHOD

Article elaborated from the dissertation ***<<Retrospective study of electrical cardioversion in patients with atrial fibrillation and atrial flutter at a university hospital>>*** presented to the Graduate Program in Health and Development in the Midwest Region of Medical School Dr. Hélio Mandetta from the Federal University of Mato Grosso do Sul/UFMS. Campo Grande-MS, Brazil. 2007.

Study of quantitative approach, cross-sectional, descriptive and analytical, retrospective documentary base. Data were collected from the "Protocols of Electrical cardioversion" in the medical records of patients with atrial fibrillation or atrial flutter, attended between January 1999 and January 2006 in the Core Coronary Care Unit of the University Hospital Maria Aparecida Pedrossian of the Federal University of Mato Grosso do Sul, in Campo Grande/MS.

The study included all patients with atrial fibrillation or atrial flutter and underwent external electrical cardioversion. Patients from indigenous ethnic groups and those with electrocardiograms that provided evidence of other cardiac arrhythmias were excluded.

Data were collected in paper prepared for this purpose which included the following variables: age, gender, body mass index (BMI), thorax perimeter (TP), anteroposterior diameter (APD) of the chest, left atrial diameter (LAD) measured by echocardiography and the amount of energy used in *Joules* (J) during the procedure. To ECV performance, the devices used were cardio scope of TEB brand, model M-10 and the defibrillator TEB brand D-10 were used.

Data analysis was performed using the Mann-Whitney, chi-square (χ^2) and Z test. Some variables were presented as descriptive statistics. The level of significance of the study was set at 0.05.

The research protocol was approved in its ethical and methodological aspects by the Ethics Committee in Research of the Federal University of Mato Grosso do Sul, under protocol. 689, as recommended by Resolution NHC. 196/1996, repealed by NHC Resolution. 466/2012.

RESULTS

There were 112 medical records assessed of patients admitted to the Coronary Care Unit who were assisted during the study period, according to inclusion and exclusion criteria.

The patients´ ages ranged from 17-84 years old, with average of 57.9±13.6 (average±average standard deviation), most frequently between 50 to 79 years old, followed by those aged from 60 to 69 years old.

Out of 112 patients who underwent transthoracic electrical cardioversion, 68 (60.7%) were men and 44 (39.3%) were women. The procedure was successful in 102 (91.1%) cases.

Atrial Fibrillation

Out of 79 patients assisted with atrial fibrillation, 51 (64.6%) were male and 28 (35.5%) were female. The range of age was also 17-84 years old, with average of 58.7±13.0 years old. The average weight was 74.1±17.8kg and the height of 1.64±0.1m. The thorax diameter was 28.9±13.2 cm and the perimeter 102.1±16.2 cm. The diameter of the AE was 43.2±6.7 cm.

Among patients undergoing anterolateral cardioversion, 27 (67.5%) were male, while 13 (32.5%) were female. Out of patients undergoing anteroposterior cardioversion, 24 (61.5%) were male, while 15 (38.5%) were female. In patients with AF, there was no significant relationship between the type of cardioversion and gender of patients (χ^2, p=0.75).

The BMI of patients undergoing anterolateral cardioversion was 27.7±6.1, while the BMI of patients undergoing anteroposterior cardioversion was 27.8±7.2. In patients with AF there was no significant difference between BMI compared the types of cardioversion (p=0.95).

The diameter and perimeter of the thorax of patients undergoing anterolateral cardioversion were 28.1±10.5 e 103.0±12.4 cm, respectively, while those undergoing anteroposterior cardioversion were 29.9±15.5 e 101.1±19.5 cm. In patients with AF, there was no significant difference between the diameter (Mann-Whitney test, p=0.89) and the perimeter of the thorax (Mann-Whitney test, p=1.00) when comparing the types of cardioversion.

The LAE of patients undergoing anterolateral cardioversion was 42.8±6.9 mm, while for patients undergoing anteroposterior cardioversion was 43.6±6.5 mm. In patients with AF there was no significant difference between LAE when comparing the types of cardioversion (Mann-Whitney test, p=0.96).

Out of 79 patients undergoing ECV, sinus rhythm was restored at the first attempt in 66 individuals (83.5%) using the blades in anterolateral position held in 40 subjects (50.6%). From them, the heart rate returned to sinus in 30 patients (75.0%).

In 39 (49.4%) patients anteroposterior cardioversion was performed, with return of the sinus rhythm in 37 (94.9%). For patients with atrial fibrillation, there was a significant relationship between the type of cardioversion and the restoration of sinus rhythm as the anteroposterior approach showed a significantly better result than the anterolateral approach (χ^2, p=0.03; Z, p=0.03). BMI parameters, diameter and thorax perimeter, LAE and percentage of restoration to sinus rhythm in patients with atrial fibrillation are presented in Table 1.

Table 1. Relation between the approach used for the ECV and the body mass index, diameter, thorax perimeter, left atrial diameter and percentage of reversal in patients with AF. Campo Grande/MS, 2007 (n=79).

Approach	BMI	Thorax diameter (cm)	Thorax perimeter (cm)	Left atrial (mm)	Reversal sinus rhythm (%)
Anterolateral	27,7±6,1	28,1±10,5	103,1±12,4	42,8±6,9	75,0
Anteroposterior	27,8±7,2	29,9±15,5	101,1±19,5	43,6±6,5	94,9
P	0,96	0,89	1,00	0,96	0,03

Out of 30 patients with AF who obtained reversion sinus rhythm with the blades in the anterolateral position, 17 (56.7%) showed reversal with only one 200J, while in 12 (40.0%) the rhythm returned to normal after applying 200J, 360J followed by another one, and finally, in one case (3.3%) it was necessary to apply one 200J, followed by tw360J (Fig. 1).

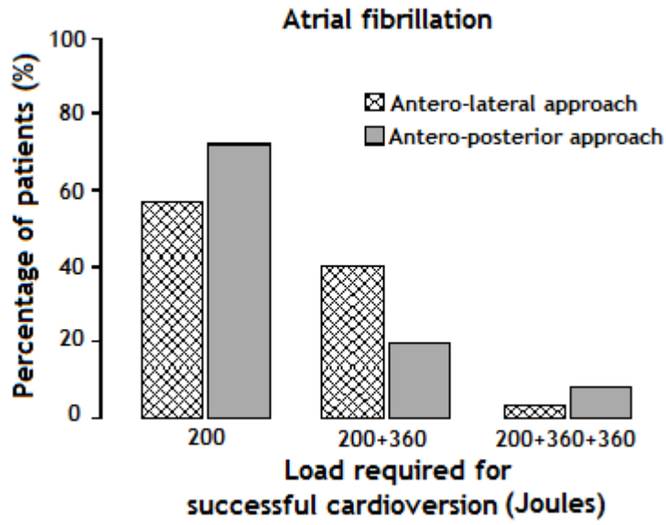

Figure 1. Percentage of patients with AF to the load required in the anterolateral and anteroposterior approaches.

Of the other 37 patients with AF who obtained reversion to sinus rhythm with the blades in the antero-posterior position, 27 (72.9%) had a reversal on a single load of 200J, while in seven (18.9%) the rhythm back to normal after application of one 200J, then one 360J and finally, in three cases (8.1%) it was necessary to apply a load of 200J, followed by two others of 360J. In patients with AF there was no significant relationship between the type of cardioversion and the load required to restore the sinus rhythm (χ^2, p=0.16).

The total load used in the first attempt of cardioversion in patients with AF was 412,9J. For those undergoing anterolateral cardioversion, the load was 467,5J, while for patients undergoing antero-posterior cardioversion load was 356,9J. There was no statistically significant difference in load used for cardioversion between the two approaches (Mann-Whitney test, p=0.09).

Among the 10 patients with AF in which the anterolateral cardioversion did not restore sinus rhythm, only three were resubmitted to a second cardioversion, this time by an antero-posterior approach. The procedure resulted in efficacy with only one load of 200J. Moreover, two patients with AF in which the antero-posterior cardioversion was not effective, they underwent a second cardioversion, however, by an anterolateral approach.

At this time, the procedure did not result in reversion to sinus rhythm even after the application of a load of 200J, and then one of 360J. The percentage of patients in the load required for the cardioversion to normal sinus rhythm is shown in Figure 1.

Atrial *Flutter*

Out of 33 patients treated with AFL, 17 (51.5%) were male and 16 (48.5%) were female. The patients´ ages ranged from 20 to 78 years old, averaging 56.1±14.9. The average weight was 71.7±15.0 kg and height of 1.62±0.1 m. The diameter of the thorax was 27.6±13.7 cm and the perimeter was 95.9±22.6 cm. The LAE was 42.2±6.8 cm.

Among patients undergoing anterolateral cardioversion, 11 (57.9%) were male, while eight (42.1%) were female. Among patients undergoing anteroposterior cardioversion,

six (42.8%) were male, while eight (57.2%) were female. In patients with AFL there was no significant relationship between the type of cardioversion and gender of patients (χ^2, p=0.62).

The BMI of patients undergoing anterolateral cardioversion was 28.7±6.6, while the BMI of patients undergoing anteroposterior cardioversion was 26.1±6.0. In patients with AFL there was no significant difference between BMI when comparing the types of cardioversion (Mann-Whitney test, p=0.49).

The diameter and perimeter of the thorax of patients undergoing anterolateral cardioversion were 24.9±6.6 and 96.5±25.1 cm, respectively, while for those undergoing anteroposterior cardioversion were 31.3±19.5 and 95.3±19.6 cm. In patients with AFL, there was no significant difference between the diameter (Mann-Whitney test, p=0.83) and the perimeter (Mann-Whitney test, p=0.51) of the thorax when comparing the types of cardioversion.

The LAE of patients undergoing anterolateral cardioversion was 42.5±6.5 mm, while those undergoing anteroposterior cardioversion the LAE was 41.7±7.9 mm. In patients with AFL, there was no significant difference between the LAE compared the cardioversions (Mann-Whitney test, p=0.89).

Out of 33 patients undergoing cardioversion, the procedure reversed sinus rhythm at the first attempt in 32 of them (96.9%). From them, cardioversion was performed with the blades in the anterolateral position in 19 patients (57.6%). Cardioversion to sinus rhythm occurred in all of them (100%). In the other 14 (42.4%), anteroposterior cardioversion was performed, when in 13 of them (92.9%) rhythm returned to sinus.

For patients with AFL, there was no significant relationship between the type of cardioversion and reversion to sinus rhythm (χ^2, p=0.34; Z, p=0.34).

BMI parameters, thorax diameter and perimeter, LAE and restoring percentage to sinus rhythm in patients with AFL are presented in Table 2.

Table 2. Relationship between approach used for the ECV and the body mass index, thorax diameter and perimeter, left atrial diameter and percentage of reversal in patients with AFL. Campo Grande / MS, 2007 (n=33).

Approach	BMI	Thorax diameter (cm)	Thorax perimeter (cm)	Left atrial (mm)	Rythm sinus reversal (%)
Anterolateral	28,8±6,5	24,9±6,6	96,5±25,1	42,5±6,5	100,0
Antero-posterior	26,1±6,1	31,3±19,5	95,3±19,6	41,7±7,9	85,7
p	0,49	0,83	0,51	0,89	0,34

Out of 19 patients undergoing AFL anterolateral cardioversion, 13 (68.4%) showed reversion to sinus rhythm with one load of 100J, while in five (26.3%) the rhythm returned to normal after applying a load of 100J, followed by another of 200J. Finally, in one patient (5.3%) it was necessary for the application of a load of 100J, and then one of 200J, and therefore a third load of 360J. The percentage of patients in the load required for the cardioversion to normal sinus rhythm is shown in Figure 2.

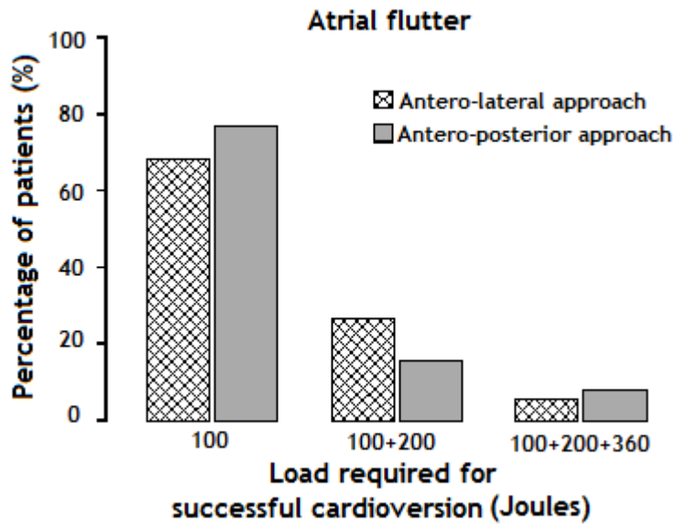

Figure 2. Percentage of patients with AFL in relation to the load required in the anterior-lateral and anterior-posterior approaches.

Out of 13 patients undergoing anterior-posterior cardioversion, 10 (76.9%) showed reversion to sinus rhythm with one 100J load, while in two patients (15.4%) rhythm returned to normal after applying a load of 100J, followed by another of 200J, and finally, in one case (7.7%) it was necessary to apply a load of 100J, followed by another of 200J and a third of 360J. In patients with AFL, there was no significant relationship between the type of cardioversion and the load required to restore the sinus rhythm (χ^2, p=0.75).

The total load used in the first attempt of cardioversion in patients with AFL was 210,3J. For patients undergoing anterior-lateral cardioversion, the load was 194,2J, while for patients undergoing cardioversion anterior-posterior the load was 220,0J. There was no statistically significant difference in load used for cardioversion between the anterior-lateral approach and the anterior-posterior approach (Mann-Whitney test, p=0.39).

For only one patient with AFL in which the anterior-posterior cardioversion did not revert to sinus rhythm, a second cardioversion was applied, but this time by an anterior-lateral approach, with a load of 360J. However, the procedure did not revert to sinus rhythm.

The total load used for cardioversion in patients with AF showed a statistically greater significance than that used for patients with AFL (Mann-Whitney test, p<0.001).

DISCUSSION

In recent years, hospital admissions for AF showed an increase of around 66%, mainly due to the aging population and the increasing prevalence of chronic heart disease. The estimated prevalence of AF is 0.4% to 1.0% in the general population and increases with age, reaching around 8% of those aged above 80 years old. The actual incidence of AF in Brazil has not yet been evaluated. However, it is estimated to be higher in men than in women, at a ratio of 2:1.[3]

On the other hand, the AFL is far less common than AF, especially in its chronic form. In this case, it is usually associated with structural heart disease and/or severe chronic obstructive pulmonary disease, with an incidence of around 0.088%.[16]

In this study, all patients undergoing ECV, there was a significantly higher percentage of men than women and the age group most frequently was between 50-79 years old, which corroborates the findings found in national and international literature.

One study found that body mass index, thorax perimeter, anterior-posterior diameter of the thorax and the LAE are parameters that influence the transthoracic impedance and, consequently, the success rate of the ECV and significant changes in response to the procedures.[5] However, in this study, these parameters were not as determining factors in relation to the results of the procedure, whether positive or negative.

The success of ECV to sinus rhythm in patients with AF is estimated to be between

70% and 90%, depending on the clinical characteristics of samples, and the criteria established in each study. In cases of AFL, the reversion to sinus rhythm is above 90%, classifying it as a more easily reversed arrhythmia compared to AF.[3,5]

In this study, the overall success rate of external ECV that includes all patients with AF and AFL was 91.1%. In the group with AFL, the success rate (97%) was comparable to that in the AF (88.6%) although the difference was not statistically significant, probably due to the small diameter sample of patients with AFL.

The results for cardioversion of patients with AF and AFL with the blades in the anterior-lateral and anterior-posterior positions were similar to all the variables considered (BMI, PADA, CT and LAE). However, after changing of position of the blades, in cases where no reversal has occurred at the first attempt, the difference was statistically significant in favor of anterior-posterior position (94.7% versus 79.0%) (p=0.028).

When analyzing only patients with AFL, there was no significant difference in success rate by comparing the two positions of the blades electrode. It is important to highlight, a lower frequency of patients with AFL compared to AF. These data converge with most published studies claiming to be the least common AFL that AF, especially in chronic form.[3,5] It is usually transient and often reverts to sinus rhythm or AF. As this study, patients with a AFL easily reverted to sinus rhythm on the first approach and only one that does not reverted to sinus rhythm had to be subjected to a second approach, also unsuccessful.

In contrast, patients with atrial fibrillation in the first approach to success rate was significantly greater when using the anterior-posterior position. The results were even better in favor of this position when it needed a second cardioversion to change the positioning of the blades.

In this way, the analysis of patients with AFL and FA would tend to reduce the favorable difference to the anterior-posterior position found in patients with AF, which would explain the best results found in the group with FA alone compared to the total of patients studied.

The results of this study are in agreement with several others who point out that the placement of electrodes in the anterior-posterior position entails a higher success rate or at least an average power less than with the electrodes on the anterior-lateral area.[12,13] Only one study[14] reported a lower rate, while others did not reach a definitive conclusion.[7,15]

This advantage of the ECV and anterior-posterior arrangement of blades can be explained by the fact that in this case the distance between the electrodes is smaller, which increases the vector of the electric field towards the heart and decreases to half of the energy required for the procedure.

A study using chest computerized tomography also showed that the anterior-posterior position, a greater amount of electric current run through the atrial, which would cause greater probability of success in cases of atrial arrhythmias.[8]

To cardioversion in the anterior-posterior position, the blade placed at the anterior throax measures 9 cm and the posterior region 13.5 cm. When considering the size of the blades is a factor that also influences the effectiveness of the procedure, this minor difference corroborates the favorable results of the anterior-posterior position.[3]

In the electric load used, some authors advocate the use of the initial shock of 360J which revert almost the majority of patients and result in a lower average cumulative load than if they used lower initial shock.[17,18] However, more than half of patients would receive a larger impact than necessary and could cause skin burns or other undesirable effects.

In this study, it was found that 72.9% of patients with AF to sinus rhythm came back with use of a load of 200J and anterior-posterior approach, a significantly greater percentage compared to that found in the anterior-lateral approach (56.7%). The cumulative load used in ECV of AF was significantly higher than the AFL.

CONCLUSION

The variables age, gender, BMI, thorax perimeter, PAD chest and the LAE showed no statistically detectable influence on the success of ECV, which converges with most of the available scientific findings.

The cumulative load used in ECV of AF was significantly higher than the AFL. In patients with AF, the success rate in the first approach, with the blades in the anterior-posterior position was significantly

higher than the anterior-lateral approach. After the load of position of the blades, the difference was even higher.

The anterior-lateral position of the blades is preferable because of its easy handling especially in medical emergencies. The anterior-posterior position of the blades is most appropriate in situations that require another attempt at cardioversion.

However, it is noteworthy that the procedures adopted for compliance with atrial arrhythmias in addition to the variable position of the blades electrodes used for ECV, several others may be involved and determine various outcomes. Thus, the decision on this position will be up to the professional doctor, clinically based on each situation, as well as knowledge from the whole healthcare team involved in this type of care, highlighting the role of the nurse.

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