



Trends in atrial flutter and atrial tachycardia research



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ABSTRACT

Background: Atrial flutter and atrial tachycardia are frequently observed arrhythmias that can be difficult to treat effectively with catheter ablation. It would be of interest to know the research directions for these arrhythmias in order to plan future efficacious studies.

Method: The MEDLINE search tool was used to determine the number of articles per year published in the biomedical literature on atrial flutter and atrial tachycardia. It was also used to determine how many articles were published concerning both of these arrhythmias in association with related keywords. The search was done for the years 1960–2013 inclusive. An in-house developed software program was utilized to structure the data into number of publications in each year. The results were graphed, and linear regression analysis was used to show trends.

Results: Overall, there were 6926 publications in the biomedical literature containing the keyword ‘atrial flutter’. The number of atrial flutter publications increased by an average of 3.58 per year from 1960 to 2013. However, there was a dip in the number of such publications during the years 1970–1990. By comparison, there were 2526 publications in the biomedical literature containing the keyword ‘atrial tachycardia’. The number of atrial tachycardia publications increased by an average of 1.95 per year from 1960 to 2013. Most keywords associated with both atrial flutter and atrial tachycardia trended upward in number of publications per year. However many keywords peaked around the year 2004.

Conclusions: There have been marked changes in the types and numbers of research foci for both atrial flutter and atrial tachycardia, based on studies published in the biomedical literature.

1. Introduction

Atrial flutter and atrial tachycardia are commonly observed arrhythmias. There are as many as 100,000 new cases of atrial flutter per year in the United States [1]. The development of atrial flutter is associated with independent risk factors of heart failure and chronic obstructive pulmonary disease [2]. Most patients presenting with atrial flutter are now treated using radiofrequency catheter ablation, so long as there are no acute conditions [2]. This procedure is considered of low procedural risk and can be efficacious [3–7]. However, recurrence after ablation can occur [8]. When atrial tachycardia occurs, it is often incessant and can lead to heart failure, particularly in pediatric patients [9–12]. Yet, this arrhythmia can also be asymptomatic and therefore may not be readily diagnosed [13]. Quantitative analysis can be assistive in determining the onset and perpetuation of these arrhythmias, as well as for the development of improved treatment options, but it is difficult to gauge the number and variety of quantitative publications by a simple online search.

In this study, trends in research directions for both atrial flutter and

atrial tachycardia were determined, in terms of the number of published studies in the biomedical literature per year. This was done by using the MEDLINE search tool, and an in-house developed software program, to analyze the published biomedical literature. The goal of the study was to determine the trends in research for both arrhythmias, so that areas of especial interest could be determined, and so that topics currently receiving less emphasis could also be identified. Such information may be assistive in planning new biomedical studies and/or for developing new research initiatives. The findings may also be useful as a guide for determining hot topics in the field, and for finding less emphasized research areas that may be important to future analyses. The analysis was done by determining the overall trends in published research concerning atrial flutter and atrial tachycardia, and also the trends in this research for secondary keywords that were associated with both atrial flutter and atrial tachycardia.

2. Method

The MEDLINE search tool was used for determining the overall

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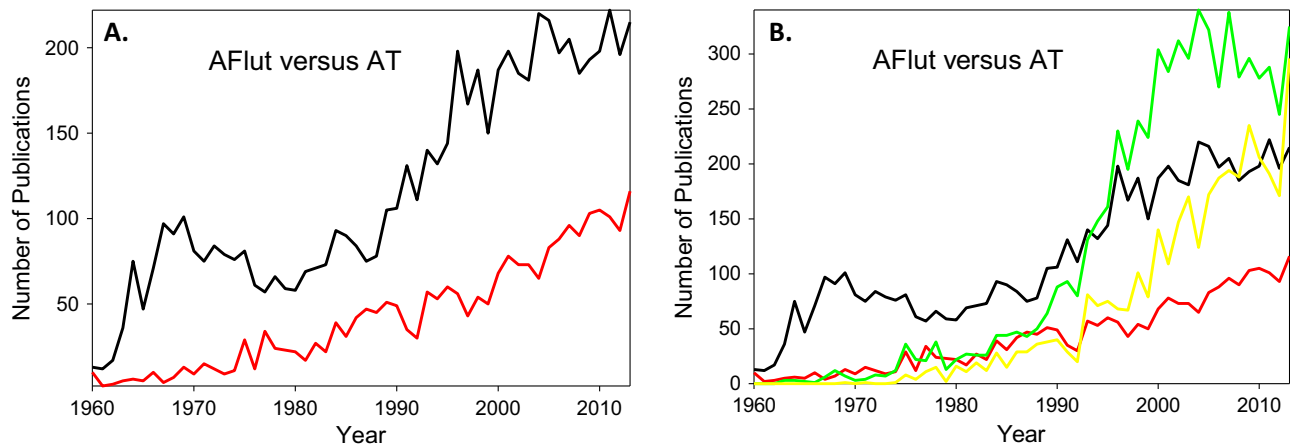


Fig. 1. Atrial flutter (black trace) and atrial tachycardia (red trace). A. Trends in biomedical publication of these keywords for the years 1960–2013 inclusive. B. Overlaid on the graphs from panel A are the total number of instances in which any associated keyword appeared in conjunction with atrial flutter (green) and atrial tachycardia (yellow). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Table 1

Linear regression model, > 50 publications with atrial flutter.

Keyword	Tot Afl	slope	r ²	Year	Tot AT	Slope	r ²	Year	Ratio
Catheter	1820	3.67	0.89	1985	1058	1.90	0.86	1985	1.72
ECG	708	0.60	0.84	1972	304	0.24	0.50	1974	2.33
Activation	707	0.69	0.69	1973	482	0.70	0.83	1984	1.47
Mapping	687	1.20	0.74	1985	506	1.08	0.80	1985	1.36
Voltage	666	0.90	0.83	1970	379	0.62	0.79	1981	1.76
Wave	391	0.34	0.34	1973	190	0.25	0.63	1979	2.06
Body-surface	210	0.54	0.32	1994	145	0.61	0.35	1995	1.45
Intracardiac	193	0.15	0.38	1973	66	0.07	0.22	1983	2.92
3D	163	0.48	0.31	1994	115	0.53	0.54	1996	1.42
Phase	129	0.13	0.30	1980	31	0.02	0.05	1983	4.16
Morphology	128	0.17	0.31	1985	95	0.16	0.44	1985	1.35
Correlation	121	0.11	0.19	1984	47	0.03	0.02	1992	2.57
Doppler	118	0.10	0.19	1984	30	0.04	0.06	1989	3.93
Ultrasound	114	0.17	0.32	1984	29	0.07	0.23	1989	3.93
Electroanatomic	98	0.18	0.07	1998	83	0.27	0.18	1998	1.18
CT	93	0.26	0.49	1993	30	0.24	0.46	2002	3.10
Regularity	75	0.09	0.17	1987	28	0.07	0.20	1989	2.68
MRI	62	0.21	0.42	1989	21	0.16	0.41	2000	2.95
2D	62	0.02	0.01	1981	19	0.10	0.23	2000	3.26
Fractionation	50	0.15	0.28	1996	67	0.27	0.51	2004	0.75

Tot Afl=total atrial flutter publications, Tot AT=total atrial tachycardia publications.

Table 2

≤50 Publications with atrial flutter.

Keyword	Tot Afl	Tot AT
F wave	27	3
Filter	26	8
High density	26	13
Wavelet	25	10
Quantitative	23	12
Time domain	17	3
Fourier	13	3
Dominant frequency	11	10
Fractals	11	4
Frequency analysis	11	5
Transform	9	4
Entropy	7	2
Intramural	7	2
Lasso	5	6
Similarity	5	2
Signal averaging	4	2
Eigenanalysis	3	1
PET	3	0
Speckle	1	4
Linear prediction	0	1

Tot Afl=total atrial flutter publications, Tot AT=total atrial tachycardia publications.

number of publications in the biomedical literature pertaining to atrial flutter and atrial tachycardia. MEDLINE seeks keywords in the Title, Abstract, and in the metadata. The search was constrained to the years 1960–2013 inclusive. The year 1960 was used as a starting point because of its importance for quantitative arrhythmia studies – in this year cardiac pacing was first utilized to prevent ventricular tachycardia in patients with complete heart block, and alternating current was used for termination of ventricular tachycardia [14]. Moreover, at this time, programmed electrical stimulation of the myocardium was combined with intracardiac activation recording [15], to usher in a new era in arrhythmia analysis. The year 2013 was used as the endpoint for search, since several years are needed for the statistics of all published articles to be compiled for indexing in a given year.

The MEDLINE portion of the search was done with ‘Include Multimedia’ checked and ‘Map Term to Subject Heading’ unchecked. Additionally, the overall number of biomedical publications containing the searched keyword or keywords was determined. To do this, in the MEDLINE search interface, the search years were kept blank. Thus all publications which included the keyword were counted for all years, not just for range 1960–2013. This was done to compare the level of published research in all years versus that for the years in which trends were measured. Since publication records for years after 2013 are

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