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Research hotspots analysis of ACE-Is pharmacological action by PubMed

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ABSTRACT

To understand the research hotspots of Angiotensin-converting enzyme inhibitors (Pharmacological Action) by PubMed. Methods: With MS Excel, SPSS, Cytoscape software, we took MeSH (Medical Subject Headings) word frequency analysis, clustering analysis, co-word network graph of PubMed papers. Results: It shows that the main research hotspot of ACE-Is (pharmacological action) is Antihypertensive Agents of ACE-Is for Hypertension, also it is beneficial to Heart Failure, Myocardial Infarction, Type 2 Diabetes Mellitus, Diabetic Nephropathies, Kidney Diseases, Left Ventricular Dysfunction, and so on. Conclusion: It is helpful and timesaving for researcher or doctor to understand the research hotspots with ACE-Is (Pharmacological Action).

KEYWORDS

Angiotensin-converting enzyme inhibitors (ACE-Is); Pharmacological action; Word frequency analysis; Clustering analysis; Co-word network graph; Antihypertensive agents; Hypertension.

INTRODUCTION

Angiotensin-converting enzyme inhibitors (ACE-Is) are widely used in the therapy of cardiovascular diseases[1]. There are lower cardiac mortality of ACE-Is in clinical practice than other related drug[2]. Although ACE-Is remain a cornerstone in the management of hypertension, and especially cardiovascular protection[3]. Several randomized, controlled trials show that angiotensin-converting enzyme (ACE) inhibitors improve survival in patients who have had an acute myocardial infarction[4]. It is beneficial for patients with cardiovascular disease.

At present the fundamental clinical research of ACE-Is is mainly related to the research of anti-atherosclerosis, treatment of myocardial infarction, heart failure and reducing the mortality of cardiovascular events, and so on, but there are not the pharmacological research hotspot analysis of ACE-Is. We hope that through this research the analysis of the Medical Subject Headings (MeSH) can draw the outline of ACE-Is (Pharmacological Action) research hotspot.

Therefore this research retrieved the ACE-Is (pharmacological action) papers of PubMed (http://www.ncbi.nlm.nih.gov/pubmed), got 12887 papers, and analyzed MeSH of above papers using Co-word Analysis[5].

MATERIAL AND METHODS

First, we retrieved PubMed papers with default Publication dates, did it at 30 November 2013. Second, search terms was "Angiotensin-Converting Enzyme Inhibitors" [Pharmacological Action] AND ("2003/11/30" [PDAT] : "2013/11/30" [PDAT]). Third, using Microsoft Excel we recorded All Major Topic MeSH (Majr terms) of above papers, and sort and filter the terms, and looked for the high frequency terms (occurrences), and we also counted occurrences of two high frequency terms together in the same paper, setting up the original co-word matrix. Fourth, the statistical analysis: we made Majr term's clustering analysis using SPSS13.0 statistical software, draw the co-word network graph of the high frequency terms using Cytoscape software[6].

THE MAJR TERMS ANALYSIS OF PAPERS ABOUT WARFARIN

The majr terms word frequency analysis

We retrieved 12887 papers, all with MeSH terms, we extracted Majr terms and established the Majr terms database. We got 44 Majr terms of ACE-Is (pharmacological action) which occurrences frequency was over 166. From TABLE 1, we can infer that the main research hotspot of ACE-Is (pharmacological action) is Antihypertensive Agents of ACE-Is for Hypertension, also it is beneficial to Heart Failure, Myocardial Infarction, Type 2 Diabetes Mellitus, Diabetic Nephropathies, Kidney Diseases, Left Ventricular Dysfunction, and so on.

Clustering analysis of the high frequency majr terms

This research used hierarchical clustering analysis which is one of the most commonly used Classify analysis to analyze the top 36 Majr terms which occurrences frequency was over 230 times), drew a dendrogram, and the results were shown in Figure 1.

TABLE 1 : The top 44 majr terms about ACE-is (pharmacological action)

Ranking	MeSH terms	Occurrences frequency (times)
1	Angiotensin-Converting Enzyme Inhibitors	5460
2	Hypertension	2965
3	Antihypertensive Agents	2239
4	Angiotensin II Type 1 Receptor Blockers	1547
5	Heart Failure	1380
6	Renin-Angiotensin System	983
7	Benzimidazoles	882
8	Benzoates	758
9	Cardiovascular Diseases	714
10	Blood Pressure	651
11	Myocardial Infarction	646
12	Enalapril	641
13	Diabetes Mellitus, Type 2	596
14	Captopril	553
15	Angiotensin Receptor Antagonists	531
16	Ramipril	470
17	Perindopril	464
18	Diabetic Nephropathies	454
19	Adrenergic beta-Antagonists	444
20	Kidney Diseases	434
21	Peptidyl-Dipeptidase A	428
22	Kidney Failure, Chronic	421
23	Tetrazoles	399
24	Kidney	351
25	Calcium Channel Blockers	331
26	Angiotensin II	329
27	Lisinopril	307
28	Proteinuria	255
29	Diuretics	254
30	Atrial Fibrillation	254
31	Coronary Artery Disease	254
32	Endothelium, Vascular	245
33	Stroke	244
34	Ventricular Dysfunction, Left	242
35	Losartan	232
36	Angioedema	230
37	Cardiovascular Agents	207
38	Coronary Disease	199
39	Mineralocorticoid Receptor Antagonists	193
40	Hydroxymethylglutaryl-CoA Reductase Inhibitors	192
41	Amlodipine	187
42	Renin	180
43	Valine	177
44	Albuminuria	166

From the Figure 1, except individual MeSH term as " Benzoates; Enalapril; Losartan; Captopril; Adrenergic beta-Antagonists; Tetrazoles ", we could seen the high frequency Majr terms could be divided into the following five groups. Group 1 contains Majr terms (“Benzimidazoles; Angiotensin II Type 1 Receptor Blockers; Diabetes Mellitus, Type 2; Diabetic Nephropathies; Cardiovascular Diseases; Ramipril”), it prompts that ACE-Is, especially Ramipril, are beneficial to Type 2 Diabetes Mellitus[7],

Diabetic Nephropathies[8], Cardiovascular Diseases[9]; Angiotensin receptor blockers (ARBs) are usually constituted of Benzimidazoles compounds[10]. Group 2 contains Majr terms ("Kidney Failure, Chronic; Proteinuria; Kidney Diseases; Kidney"), it suggests that ACE-Is are beneficial to Kidney Diseases[11], Chronic Kidney Failure[12], it also can reduce the proteinuria[13]. Group 3 contains Majr terms ("Angiotensin-Converting Enzyme Inhibitors; Angiotensin Receptor Antagonists; Renin-Angiotensin System; Atrial Fibrillation"), it suggests that ACE-Is and ARB are the two major categories of renin - angiotensin - aldosterone system (RAAS) blockers, both the world health organization (WHO) and hypertension treatment guidelines recommend to use one of above as the important antihypertensive drugs. ACE-Is and ARB have become the new drugs to prevent atrial fibrillation[14]. Group 4 contains Majr terms ("Perindopril; Stroke; Calcium Channel Blockers; Diuretics; Hypertension; Antihypertensive Agents; Blood Pressure"), it suggests that ACE-Is (for example Perindopril), Calcium Channel Blockers and Diuretic are main of antihypertensive drugs, also beneficial to Stroke[15]. Group 5 contains Majr terms ("Coronary Artery Disease; Endothelium, Vascular"), it suggests that ACE-Is have the effect of protecting vascular endothelium[16], and at the same time are good for coronary artery disease. Group 6 contains Majr terms ("Peptidyl-Dipeptidase A; Angiotensin II"), it suggests that angiotensin converting enzyme (ACE) also are called as peptidyl dipeptidase A. Group 7 contains Majr terms ("Myocardial Infarction; Ventricular Dysfunction, Left; Heart Failure"), it suggests that ACE-Is are used to treat Myocardial Infarction, Left Ventricular Dysfunction and Heart Failure[17]. Group 8 contains Majr terms ("Lisinopril; Angioedema"), it suggests that ACE-Is (for example Lisinopril) have some side-effect, such as angioedema[18]. The above clustering results suggest that several Majr terms within one group have certain inherent logic connection between eachother.

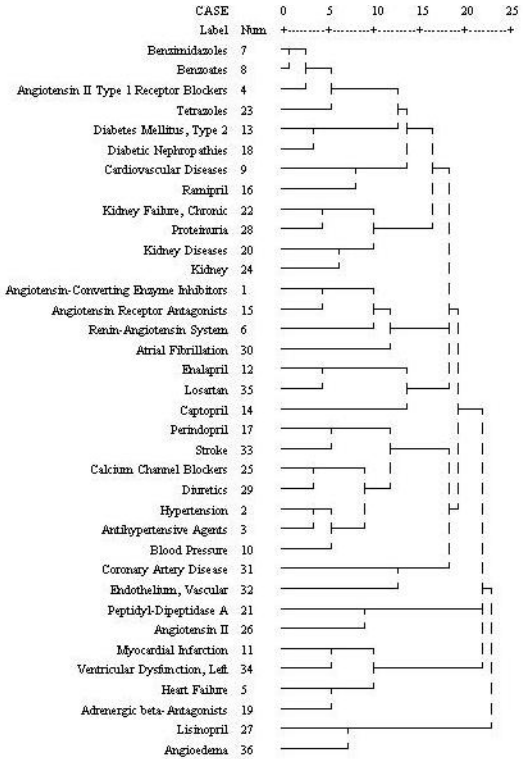

Figure 1 : Hierarchical clustering analysis dendrogram of majr terms

Co-word network graph of the high frequency Majr terms pair

By analyzing the top 15 Majr terms which word frequency were over 531 times, we got the top 13 Majr terms pair (A and B, see TABLE 2) and co-word network graph of the Majr terms pair (see Figure 2). Especially the first Majr terms pair of "Hypertension" and "Antihypertensive Agents"

appeared 1464 times in the same paper, it was far higher than that of the second MeSH terms pair (1162 times, “Angiotensin-Converting Enzyme Inhibitors” and “Hypertension”).

In Figure 2 the edge represents the concurrence relationship between Majr terms pair and if there are many edge between one Majr term to other Majr term, it suggests that the one Majr term is more important, it is in the center of the research hotspots. So we could infer that the main research hotspot is ACE-Is antihypertensive effect for Hypertension.

TABLE 2 : The top 13 majr terms pair

Ranking	MeSH terms A	MeSH terms B	Co-word occurrences frequency (times)
1	Hypertension	Antihypertensive Agents	1464
2	Angiotensin-Converting Enzyme Inhibitors	Hypertension	1162
3	Angiotensin-Converting Enzyme Inhibitors	Angiotensin II Type 1 Receptor Blockers	1003
4	Angiotensin-Converting Enzyme Inhibitors	Antihypertensive Agents	787
5	Benzimidazoles	Benzoates	756
6	Angiotensin-Converting Enzyme Inhibitors	Renin-Angiotensin System	584
7	Angiotensin II Type 1 Receptor Blockers	Benzimidazoles	511
8	Angiotensin-Converting Enzyme Inhibitors	Heart Failure	496
9	Angiotensin-Converting Enzyme Inhibitors	Angiotensin Receptor Antagonists	459
10	Angiotensin II Type 1 Receptor Blockers	Benzoates	431
11	Hypertension	Blood Pressure	416
12	Hypertension	Angiotensin II Type 1 Receptor Blockers	410
13	Angiotensin-Converting Enzyme Inhibitors	Enalapril	405

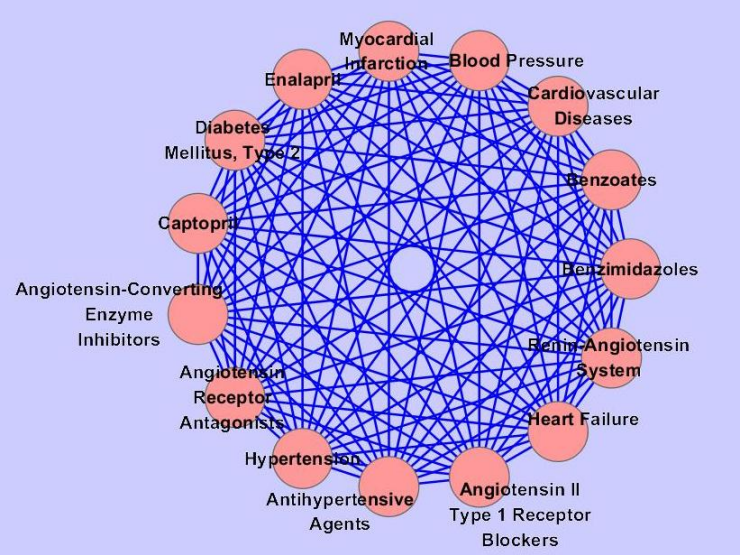

Figure 2 : Co-word network graph of the high frequency majr terms pair

CONCLUDING REMARKS

By analyzing MeSH terms (word frequency analysis, clustering analysis, co-word network graph) of PubMed papers about ACE-Is (pharmacological action), we could infer that the main research hotspot of ACE-Is (pharmacological action) is Antihypertensive Agents of ACE-Is for Hypertension,

also it is beneficial to Heart Failure, Myocardial Infarction, Type 2 Diabetes Mellitus, Diabetic Nephropathies, Kidney Diseases, Left Ventricular Dysfunction, and so on.

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