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ARAŞTIRMA / RESEARCH

Portal hypertension research activity: a bibliometric analysis

Portal hipertansiyon araştırma trendi: bibliyometrik bir analiz

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Abstract

Purpose: Portal hypertension (PHT) is a clinical syndrome characterized by a portal vein pressure gradient exceeding 5 mm Hg. Portal hypertensive complications have high morbidity and mortality. The present study aimed to provide an overview of portal hypertension research, as well as investigate the publications and citations of countries, authors, and institutions, international cooperation, and the density of terms used, employ a bibliometric analysis method, and shed light on future research.

Materials and Methods: The search was performed on the Web of Science (WoS) on October 21, 2021. The term "Portal hypertension" was searched in the paper "title" section between 01.01.2001 and 31.12.2020. The software VOS viewer (Version 1.6.17), which shows the partnership mesh in bibliometric works, was used to analyze the data obtained.

Results: The most frequently used keyword was portal hypertension with 46.4%, followed by cirrhosis with 11.1% and liver cirrhosis with 7.4%. In our study, the most effective journals related to portal hypertension were the World Journal of Gastroenterology (86 articles, 1264 citations), the Journal of Hepatology (45 articles, 2781 citations), and Hepatology (44 articles, 3769 citations), and Gastroenterology had the highest average citation (117.8).

Conclusion: The present study offers an alternative viewpoint on global research trends in portal hypertension between 2001 and 2020 and is the first bibliometric analysis of portal hypertension, an issue with an increasing publication trend. We believe that by providing comprehensive and structured information on portal hypertension, the study will assist researchers in identifying publication hotspots and gaps on the subject.

Keywords:. Portal hypertension, bibliometric, cirrhosis

Öz

Amaç: Portal hipertansiyon (PHT), 5 mm Hg'yi aşan portal ven basınç farkı ile karakterize, komplikasyonları yüksek morbidite ve mortaliteye sahip klinik bir sendromdur. Bu çalışma, portal hipertansiyon araştırmalarına genel bir bakış sağlamanın yanı sıra yazarların, ülkelerin ve kurumların yayınlarını ve alıntılarını, uluslararası işbirliğini ve kullanılan terimlerin sıklığını bibliyometrik analiz yöntemi kullanarak araştırmayı ve gelecekteki araştırmalara ışık tutmayı amaçlamıştır.

Gereç ve Yöntem: 21 Ekim 2021 tarihinde Web of Science (WoS) üzerinde arama yapılmıştır. Ocak 2001 ile Aralık 2020 tarihleri arasındaki makalelerin "başlık" bölümünde "Portal hipertansiyon" terimi aranmıştır. Elde edilen verilerin analizinde bibliyometrik çalışmalarda işbirliği ağını gösteren VOS viewer (Versiyon 1.6.17) kullanılmıştır.

Bulgular: En sık kullanılan anahtar kelime %46,4 ile portal hipertansiyon, %11,1 ile siroz ve %7,4 ile karaciğer sirozu idi. Çalışmamızda portal hipertansiyon ile ilgili en aktif dergiler World Journal of Gastroenterology (86 makale, 1264 atıf), Journal of Hepatology (45 makale, 2781 atıf), Hepatology (44 makale, 3769 atıf) ve en yüksek ortalama atıf sayısı ile Gastroenterology idi (117,8).

Sonuç: Bu çalışma, 2001 ve 2020 yılları arasında portal hipertansiyonda küresel araştırma eğilimlerine alternatif bir bakış açısı sunmakta olup artan bir yayın trendi olan portal hipertansiyonun ilk bibliyometrik analizidir. Çalışmanın, portal hipertansiyon hakkında kapsamlı ve yapılandırılmış bilgiler sağlayarak, araştırmacılara konuyla ilgili yayın noktalarını ve boşlukları belirlemede yardımcı olacağına inanıyoruz.

Anahtar kelimeler: Portal hipertansiyon, bibliyometrik, siroz

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INTRODUCTION

Portal hypertension (PHT) is a clinical syndrome characterized by a portal vein pressure gradient exceeding 5 mm Hg[1]. Portal vein pressure is comparative to changes in blood flow and resistance (Ohm's law). PHT is classified as prehepatic, intrahepatic (most common form, due to liver cirrhosis caused by alcohol and chronic HBV and HCV infections), or posthepatic[2].

The most common causes of portal hypertension in children are biliary atresia and portal vein thrombosis[3]. Portal hypertension most often accompanies patients with cirrhosis and associated complications, such as gastrointestinal bleeding, gastro-esophageal varices, hepatic encephalopathy, hepatorenal syndrome, ascites, jaundice, spontaneous bacterial peritonitis, other infections, and liver failure[4-6]. Portal hypertensive complications have high morbidity and mortality[7]. Nowadays, in the treatment of PHT and varicose bleeding, endoscopic band ligation, b-blockers and vasoactive drugs, transjugular intrahepatic portosystemic shunt (TIPS), and other new treatment methods are applied[8].

By providing a statistical and quantitative analysis of broadcasts, bibliometrics offers a suitable way to survey researchers' efforts in a particular area[9,10] to determine the trends in research over time that influence policymaking. In addition, using pertinent criteria such as quantity, impact factors, and article citations, bibliographic analysis enables the comparison of academic performance across various regions and the acquisition of information about the scientific output of individuals, institutions, and nations[11]. Although bibliometrics, a well-known systematic analysis technique, aims to discern qualitative characteristics, the main goal is to turn an intangible asset, such as a scientific quality, into a manageable asset[12].

Bibliometric studies have been carried out in a number of disciplines, including surgery, public health, oncology, and infectious diseases, but no bibliometric study has yet evaluated the research on portal hypertension[13-16]. The present study aimed to provide a survey of portal hypertension research, as well as to investigate the publications and citations of authors, international cooperation, countries, institutions, and the density of terms used, employing a bibliometric analysis method, and to shed light on future research.

MATERIALS AND METHODS

This was an observational study conducted with previous studies. Ethics approval was not required since the information was only extracted from published studies.

Data collection

The search was performed on the Web of Science (WoS) on October 21, 2021. The term "portal hypertension" was searched in the paper "title" section between 01.01.2001 and 31.12.2020. A methodology similar to that used in previous bibliometric studies was employed[16-18]. Only articles were included. The following document types were excluded: reviews, meeting abstracts, letters, editorial materials, and others. All non-English language papers were also excluded. Articles that were off-topic were identified and eliminated from the study. Papers that met the inclusion criteria were saved as files and analyzed. Countries were classified based on the country of the corresponding author, and countries that produced more than 1% of the articles during the study period were classified as the main active countries[19]. The formula "number of articles per country/total number of articles" was used for this valuation[20]. The population size and GDP information for each main active country were extracted from the website https://www.cia.gov/library/publications/the-world-factbook, and the number of papers was calculated accordingly. The World Bank classifies countries into four broad income categories: low, middle, upper middle, and high[21].

Analysis tools

The software VOS viewer (Version 1.6.17), which depicts the cooperation mesh in bibliometric works, was used to analyze the data obtained.

Statistical analysis

The SPSS (25.0) statistical package software was used to analyze the study data. The rates are displayed in the tables with frequency and percentage values, and the change in the number of published papers over the years was evaluated using linear regression

analysis. AP < 0.05 value was accepted as statistically significant.

RESULTS

A total of 3,726 papers were listed. Based on document type (1,987 papers excluded), language (75 papers excluded), and subject (12 papers excluded), 1,652 papers, all in English, were retained and evaluated (Figure 1). The distribution of the papers on portal hypertension by years is displayed in Figure 2, which shows that the number of papers increased gradually. This increase was found to be statistically significant in the linear regression analysis ($p < 0.05$).

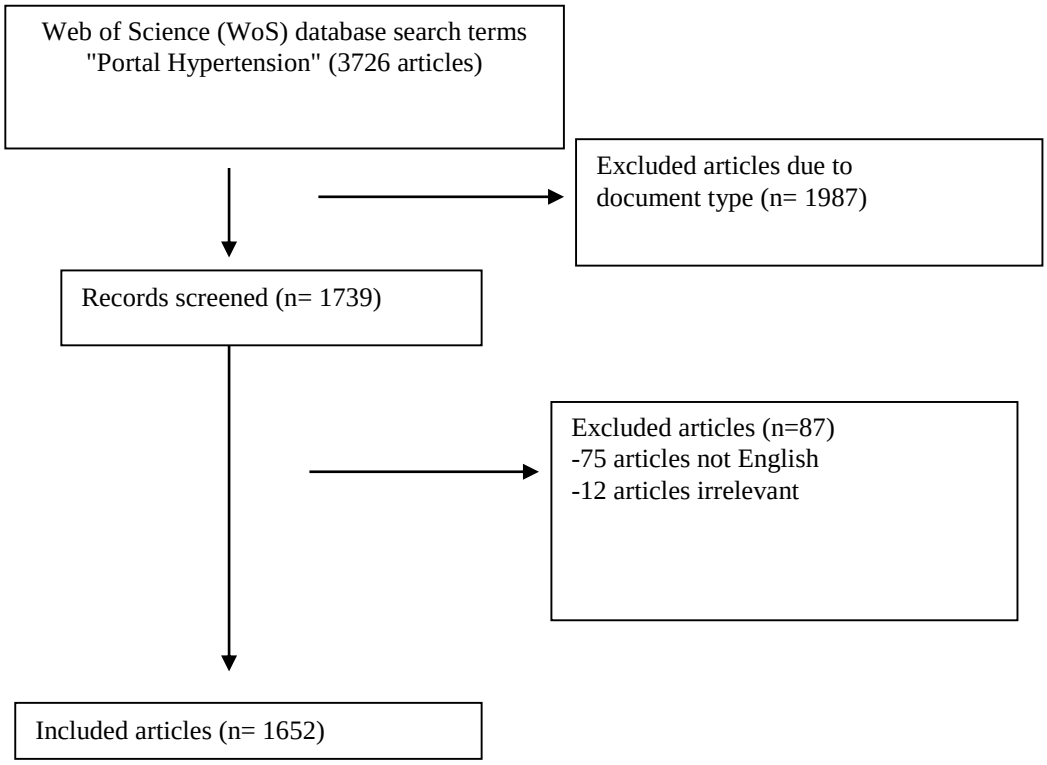

Figure 1. Flow chart of the bibliometric analysis

In this study, 19 countries were found to be in the main active country category. Except for Turkey, China, and India, all the countries were categorized as high income. The top three main productive countries on portal hypertension were China (310 articles, 18.7%), the United States (USA) (305 articles, 18.4%), and Spain (164 publications, 9.9%), while the top three countries in terms of the mean number of citations were Spain (42.4%), France (37.6%), and Italy (34.8%) (Table 1). The author with the top number of citations was Takeaki Ishizawa from the University of Tokyo, Japan (Table 2). Figures 3 and 4 depict the mesh visualization maps of co-authorship, authors, and countries. They display maps of 40 territories with a minimum of 5 papers and 73 authors with a minimum of 8 documents.

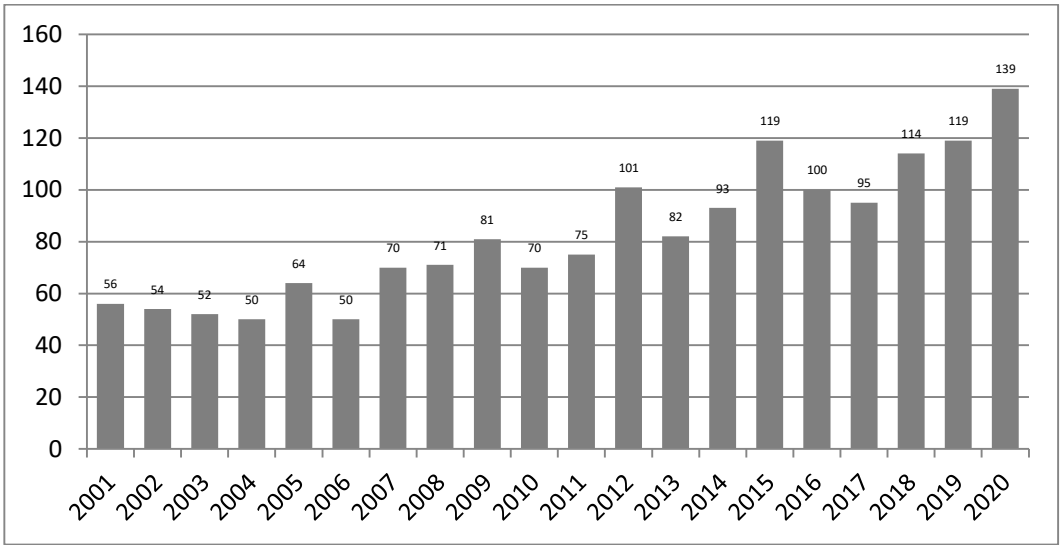

Figure 2. Number of published documents according to years

Table 1. The main active countries in portal hypertension articles

Rank	Country	Publications n (%)	Total citation	Mean citation	H index
1	China	310 (18.765)	2891	9.33	23
2	Usa	305 (18.462)	6177	20.25	43
3	Spain	164 (9.927)	6955	42.41	47
4	Japan	159 (9.625)	2625	16.51	25
5	Italy	113 (6.840)	3941	34.87	30
6	India	96 (5.811)	820	8.54	15
7	Germany	93 (5.630)	2182	23.46	27
8	France	84 (5.085)	3163	37.65	30
9	England	60 (3.632)	884	14.73	18
10	Turkey	50 (3.027)	392	7.84	11
11	Belgium	42 (2.542)	1374	32.71	21
12	Switzerland	42 (2.542)	1131	26.93	21
13	Austria	40 (2.421)	1093	27.33	18
14	Canada	40 (2.421)	1354	33.85	21
15	Brazil	39 (2.361)	456	11.69	12
16	South Korea	38 (2.300)	803	21.13	14
17	Denmark	37 (2.240)	774	20.92	17
18	Australia	30 (1.816)	571	19.03	12
19	Taiwan	26 (1.574)	206	7.92	9

Table 2. The top 10 cited publications in portal hypertension

Rank	Author	Article title	Journal title	Year	Citation	Cit/Year
1	Ishizawa. Takeaki et al	Neither multiple tumors nor portal hypertension are surgical contraindications for hepatocellular carcinoma	Gastroenterology	2008	489	37.615
2	Vizzutti. Francesco et al.	Liver stiffness measurement predicts severe portal hypertension in patients withh cv-related cirrhosis	Hepatology	2007	488	34.857
3	Abraldes. JG.et al.	Hemodynamic response to pharmacological treatment of portal hypertension and long-term prognosis of cirrhosis	Hepatology	2003	349	19.389
4	Carrion. Jose A. Et al.	Transient elastography for diagnosis of advancedf ibrosis and portal hypertension in patients with hepatitis c recurrence after liver transplantation	LiverTransplantation	2006	310	20.667
5	Boyer. Thomas D.et al.	Role of trans jugular intra hepatic portosystemicshunt (tips) in the management of portal hypertension: Update 2009	Hepatology	2010	295	26.818
6	Colecchia. Antonio et aal.	Measurement of spleen stiffness to evaluate portal hypertension and the presence of esophageal varices in patients with hcv-related cirrhosis	Gastroenterology	2012	292	32.444
7	Monescillo. A et al.	Influence of portal hypertension and it s early decompression by tips placement on the out come of variceal bleeding	Hepatology	2004	284	16.706
8	Berzigotti. Annalisa;et al	Elastography. spleen size. And platelet countidentify portal hypertension in patients with compensated cirrhosis	Gastroenterology	2013	283	35.375
9	Bureau. C.et al	Transient elastography accurately predicts presence of significant portal hypertension in patients with chronic liver disease	AlimentaryPharmacology&Therapeutics	2008	250	19.231
10	Abraldes. Juan G. Et al	Simvastatin lowers portal pressure in patients with cirrhosis and portal hypertension: A randomized controlled trial	Gastroenterology	2009	239	19.917

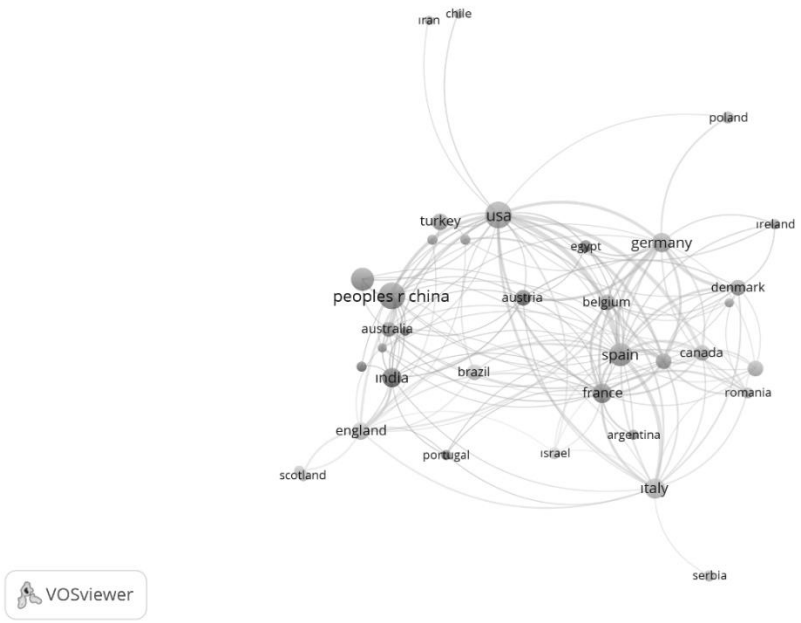

Figure 3. Co-authorship country network visualization map

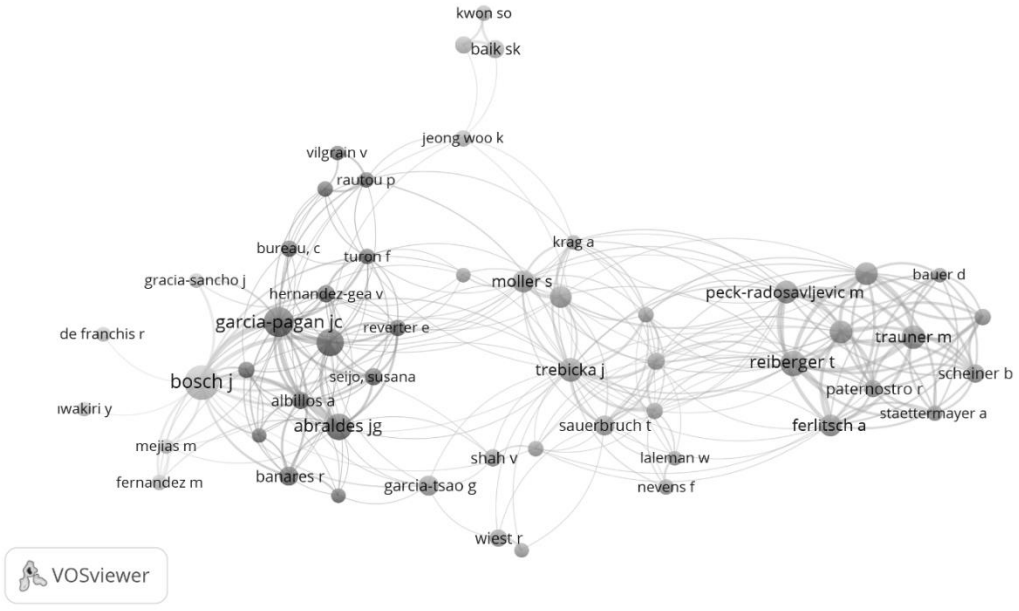

Figure 4. Co-authorship author' network visualization map

The most frequently used keyword was "portal hypertension" (46.4%), followed by "cirrhosis" (11.1%) and "liver cirrhosis" (7.4%) (Table 3). In our study, a map was used to show the keywords and the relationships between them. Figures 5 and 6 show the relationship between 41 keywords that were used a minimum of 15 times.

Table 3. List of significant keywords in portal hypertension articles.

Rank	Keyword	Frequency, %
1	Portal hypertension	767 (46.428)
2	Cirrhosis	184 (11.138)
3	Liver cirrhosis	123 (7.446)
4	Tips	71 (4.298)
5	Esophageal varices	56 (3.390)
6	Splenectomy	47 (2.845)
7	Noncirrhotic portal hypertension	46 (2.785)
8	Hepatic venous pressure gradient	45 (2.724)
9	Idiopathic portal hypertension	42 (2.543)
10	Nitricoxide	41(2.482)

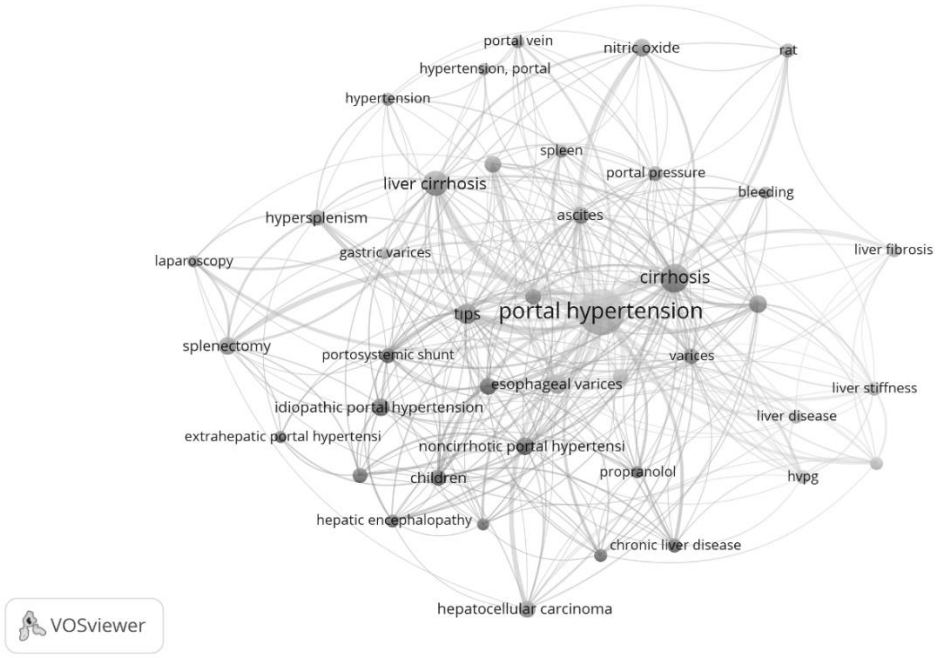

Figure 5. Author Keywords Co-occurence Network Visualization Map

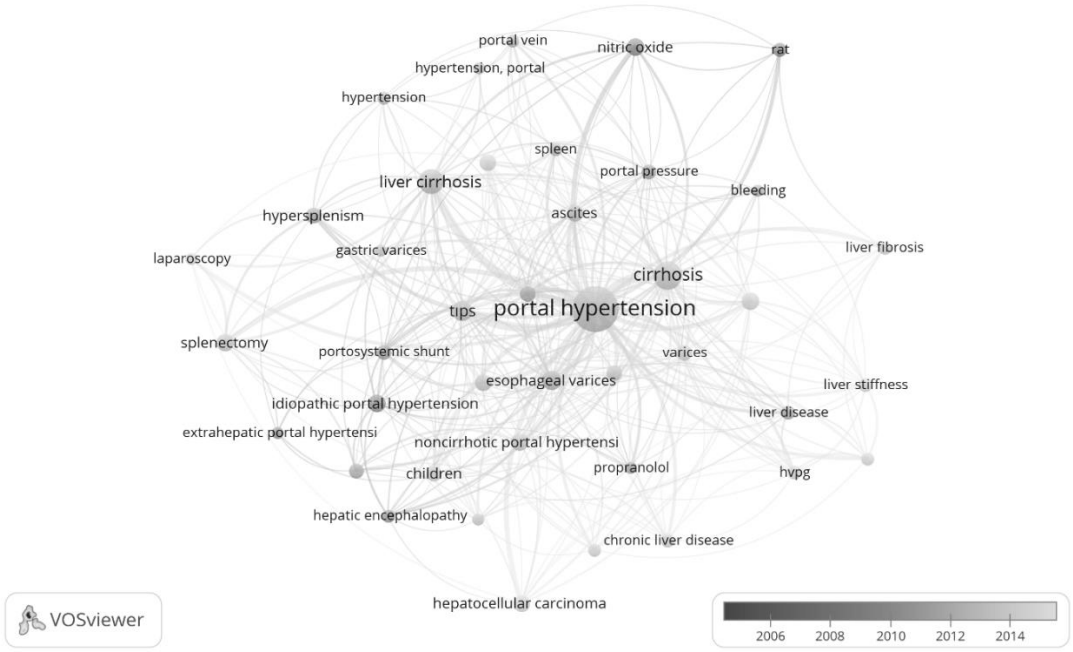

Figure 6. Keyword co-occurence overlay map

The most prolific journals related to portal hypertension were the *World Journal of Gastroenterology* (86 articles, 1,264 citations), the *Journal of Hepatology* (45 articles, 2,781 citations), and *Hepatology* (44 articles, 3,769 citations). Gastroenterology had the highest average citations (117.8) (Table 4).

Table 4. Main active journals in portal hypertension articles

Rank	Journal name	Publications, n (%)	Total citation	Mean citation	Impact factor (2018)
1	World Journal of Gastroenterology	86 (5.206)	1264	14.70	3.411
2	Journal of Hepatology	45 (2.724)	2781	61.80	18.946
3	Hepatology	44 (2.663)	3769	85.66	14.971
4	Liver International	44 (2.663)	1123	25.52	5.542
5	Digestive Diseases and Sciences	35 (2.119)	601	17.17	2.937
6	Journal of Gastroenterology and Hepatology	34 (2.058)	610	17.94	3.632
7	Journal of Pediatric Gastr.and Nutrition	31 (1.876)	358	11.55	3.015
8	Plos One	30 (1.816)	851	28.37	2.776
9	European Journal of Gastroenterology Hepatology	29 (1.755)	324	11.17	2.198
10	Hepato Gastroenterology	29 (1.755)	297	10.24	0.792*
11	Hepatology Research	28 (1.695)	290	10.36	3.440
12	Alimentary Pharmacology Therapeutics	23 (1.392)	1068	46.43	7.731
13	Digestive and Liver Disease	22 (1.332)	333	15.14	3.037
14	Gastroenterology	20 (1.211)	2357	117.85	19.233
15	Scandinavian Journal of Gastroenterology	20 (1.211)	318	15.90	2.152
16	American Journal of Gastroenterology	19 (1.150)	799	42.05	10.241
17	Journal of Pediatric Surgery	17 (1.030)	219	12.88	2.092
*Note: Journal impact factor score, 2015					

The top 10 corporations with the most articles in the portal hypertension literature are shown in Table 5, with the University of Barcelona, Spain (4.1% of all articles) in first place, followed by the Hospital Clinic Barcelona, Spain (2.5%) in second place, and the Medical University of Vienna, Austria (2.1%) in third place. The network visualization map of bibliographic matching, source, and organization in the portal hypertension literature worldwide is shown in Figure 7 and Figure 8.

Table 5. Top 10 organization in portal hypertension articles

Rank	Organization- country	Publications n (%)	Total citation	Mean citation	H index
1	Univ Barcelona-Spain	68 (4.116)	3378	49.68	31
2	Hosp Clin Barcelona-Spain	42 (2.542)	2464	58.67	26
3	Med UnivVienna-Austria	35 (2.119)	1030	29.43	17
4	Yale Univ- Usa	31 (1.877)	938	30.26	18
5	Univ Bonn-Germany	28 (1.695)	925	33.04	17
6	Xi An JiaoTongUniv-China	28 (1.695)	233	8.32	9
7	Capital Med Univ-China	24 (1.453)	163	6.79	8
8	Mayo Clin-USA	24 (1.453)	812	33.83	14
9	Shanghai Jiao Tong Univ-China	23 (1.392)	319	13.87	8
10	Univ Bern-Switzerland	22 (1.332)	574	26.09	12

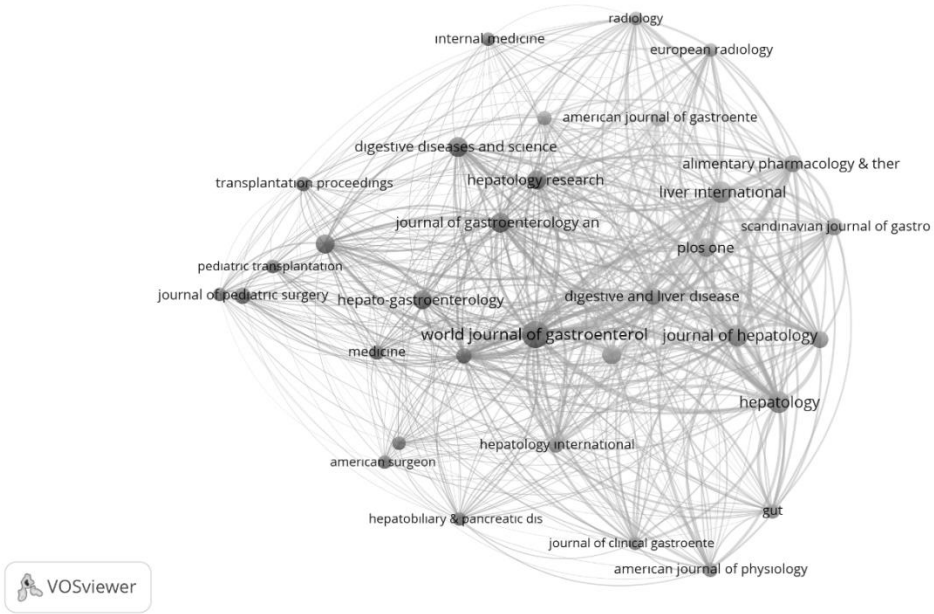

Figure 7. Bibliographic coupling of journals network visualization map

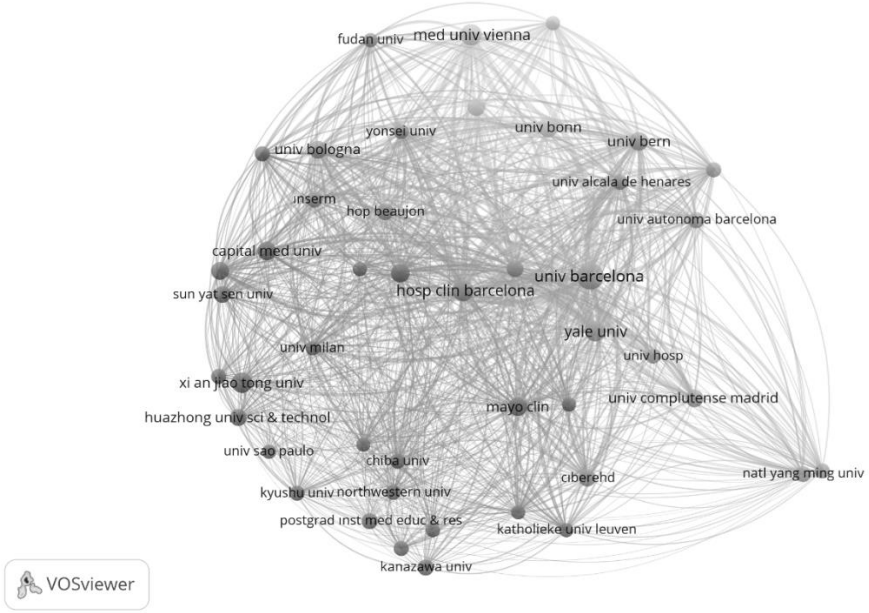

Figure 8. Bibliographic coupling of organizations network visualization map

DISCUSSION

Bibliometric analysis is based on a wide array of publication characteristics, such as authors' links, source countries, publication types, and citation data. This method has become increasingly popular in recent years as it effectively summarizes publications and shows trends in various fields through clear visuals [22, 23]. However, there is no bibliometric study on portal hypertension, which showed an increasing number of publications from 2001 to 2020. The increasing trend of publications on portal hypertension can be explained by the fact that it is a growing and serious health problem and that innovations in diagnosis and treatment have a triggering effect on publication [8]. With this in mind, we aimed in this study to conduct an initial bibliometric analysis on portal hypertension.

All but three of the 19 countries listed as the main active countries in our study are in the category of high GDP, which supports the correlation between economic development and scientific productivity [16, 24]. In the previous bibliometric studies, the USA stands out as having the top number of broadcasts. This has been attributed to the fact that the country has strong financing of scientific research due to its high GDP and also some of the best researchers and research centers in the world [16, 25, 26]. However, in our study, we found that most of the articles on portal hypertension were published in China. Its high population may have contributed to this overall result. However, also noteworthy is that China has been extremely productive in particular subjects in previous bibliometric studies of the scientific literature [25, 27]. For example, in a bibliometric study on artificial liver research, China had the top number of papers [28]. In addition, the high incidence of hepatitis B in China may also have motivated researchers to publish more papers on portal hypertension [29].

The number of citations a paper receives after broadcast is a significant gauge of its value within the scientific community. Also, the impact of an article in a particular discipline is often directly proportional to the number of citations it has [30]. While China was found to contribute the largest number of articles to the research on portal hypertension, it was noteworthy that it lagged behind in the total number of citations and the average number of citations. Despite the similar numbers of papers published in

the USA and China, our study found that the U.S. publications received more than twice as many citations as China, which can be attributed to U.S. authors' tendency to cite domestic sources and U.S. reviewers' preferences for American articles [31-33].

One of the most popular metrics for evaluating the caliber of research is the h-index, which simultaneously assesses the quantity and quality of all research outputs produced by a researcher [34]. Spain stands out in the publications on portal hypertension, ranking third in the number of articles, first in total citations, first in mean citations, and first in h-index, despite having a lower GDP and population than the USA and a lower population than China. In this context, the Spanish authority on portal hypertension is evident. In our study, we found that the top two institutions with the highest publications, citations, average citations, and h-index (University of Barcelona, Hospital Clinic Barcelona) are also in Spain. This high publication and citation rate in Spain may be related to the fact that the prevalence of hepatitis B and hepatitis C infections, which are the main causes of cirrhosis and thus portal hypertension, is higher in Spain than in northern European countries and the USA [35-39]. It is important for authors studying portal hypertension to review the publications and follow the studies of the countries and organizations mentioned in Table 1 and Table 5 in order to produce quality scientific content.

The *World Journal of Gastroenterology* has an impact factor (IF) of 3.411 and the highest number of publications, with 86 publications, 1,264 citations, and an average citation rate of 14.7. The impact factor of journals is also essential for citations, and the most cited manuscripts are usually those published in high-impact factor journals [40]. In our study, the first three journals with the top number of citations and the average number of citations are high-impact factor journals. Among these, *Hepatology,* with an IF of 14.971, is the most highly cited journal, with 3,769 citations (85.66 average number of citations) to 44 publications. The *World Journal of Gastroenterology,* with an IF of 9,233, had the highest average number of citations (117.85), with 2,357 citations to 20 publications. There were 2,781 citations to 45 publications in the *Journal of Hepatology* (IF: 18.946), with an average of 61.8 citations. According to Bradford's law, several core journals in the field are mostly cited, while articles in the non-core journals in the field receive fewer citations [41]. In addition, the fact that an article is open access (OA) is another important factor in citation frequency, and OA papers are more easily identified and cited than non-open access papers [42]. Although the *World Journal of Gastroenterology* has the highest number of articles, its lower citation rate can also be explained by the hybrid nature of the journal.

The research topic is led by the most cited articles with a strong impact [16]. In our study, Takeaki Ishizawa from the University of Tokyo, Japan, had the most citations and the highest citation/year ratio. Annalisa Berzigotti from the University of Barcelona, Spain, had the second-highest citation/year ratio despite publishing after the related article. In terms of the scientific value of planned studies, it would be advantageous for researchers intending to study portal hypertension to concentrate on these authors, their institutions, and other authors and works with the highest citation rates mentioned in the findings.

Keywords can be used to identify subjects in portal hypertension studies. While keywords are useful for describing research points, prominent words represent new research frontiers and provide information on research trends [43]. The most frequently used keyword in our study was "portal hypertension," which was also used in the literature review, followed by "cirrhosis" and "liver cirrhosis." This may be interpreted as an indication that research on portal hypertension primarily undertakes the role of cause investigation and identification. Hence, the most widespread cause of PHT is cirrhosis [8]. In addition, the treatment of portal hypertension includes the prevention of the first bleeding, treatment of acute variceal bleeding, and prevention of recurrent bleeding. The identification of Tipps, esophageal varices, and splenectomy as the fourth, fifth, and sixth keywords is critical in terms of showing the high number of studies on treatments among the total studies [8].

The present study offers an alternative viewpoint on global research trends in portal hypertension between 2001 and 2020. It is the first bibliometric analysis of portal hypertension, a subject with an increasing publication trend. Despite some limitations due to small volume, non-WOS, and non-English language journals and articles, the findings provide scientists, funding agencies, and public health policymakers with useful information about portal hypertension and the publication trends in PHT. We believe that

by providing comprehensive and structured information on portal hypertension, the study will assist researchers in identifying publication hotspots and gaps in the research on this subject.

Yazar Katkıları: Çalışma konsepti/Tasarımı: KK, YS; Veri toplama: KK, YS; Veri analizi ve yorumlama: KK, YS; Yazı taslağı: KK, YS; İçeriğin eleştirel incelenmesi: KK, YS; Son onay ve sorumluluk: KK, YS; Teknik ve malzeme desteği: KK, YS; Süpervizyon: KK, YS; Fon sağlama (mevcut ise): yok.
Etik Onay: Bu gözlemsel bir çalışmadır. Etik onay gerekli değildir, çünkü bilgiler yalnızca yayınlanmış çalışmalardan elde edilecektir.
Hakem Değerlendirmesi: Dış bağımsız.
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Ethical Approval: This is an observational study. Ethics approval does not required since information will only be extracted from published studies.
Peer-review: Externally peer-reviewed.
Conflict of Interest: We have no conflict of interest to declare.
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