The Most Frequently Cited 100 Articles in Liver Transplantation Literature

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ABSTRACT

Introduction. We investigated the liver transplantation literature since 1975 and found the most frequently cited 100 articles and assessed the distribution of authors and journals of these articles.

Method. Using the advanced mode of the Institute for Scientific Information (ISI) Web of Science (WOS) search engine, the words "SU = transplantation AND TI = liver OR SU = transplantation AND TS = liver" were used to scan articles and determine the most-cited 100 articles on July 18, 2016.

Results. From 1975 to date, it appears a total of 43,369 articles were published in the field of liver transplantation in the WOS. Although the most cited article had 677 citations, the least cited article had 180 citations. The mean citation number for the 100 articles was 252.31 ± 96.75. The mean annual citation number for the articles varied from 61.55 to 5 and the mean was 15.31 ± 8.63. The most cited article was by Feng et al "Characteristics Associated With Liver Graft Failure: The Concept of a Donor Risk Index" published in the *American Journal of Transplantation* (677 citations).

Conclusion. Bibliometric analysis highlights the key topics and publications that have shaped the understanding and management of liver transplantation. According to our research, this is the first study to investigate articles with most citations in the field of liver transplantation. In our study the article with the most citations was cited 677 times, whereas the 100th article was cited 180 times with a mean citation number for the 100 articles of 252.31 ± 96.75.

WHEN one scientific article indicates another scientific article as a reference, this is called citing the article. While mentioning the scientific studies constituting the basis for the scientific study in the introduction, the original publications are cited. The number of citations of a scientific article indicates the impact of the article. For scientific articles the most common marker to assess a journal are the number of citations and markers based on this. Journals publishing scientific articles with many citations and with higher impact values (IV) are accepted as better qualified, although there are limits to this marker. As a result, newer objective criteria have been evaluated for assessment of scientific studies, journals, and scientists. A higher number of citations is important for assessment of the academic life of individuals and for advancement [1,2].

The Institute for Scientific Information Web of Knowledge (including Science Citation Index Expanded), produced by the Institute for Scientific Information (ISI), is well known as the world's leading citation database, and it can provide academic citation indexing and search service.

According to our research, there is no study from recent years investigating the number of citations of international articles in the field of liver transplantation.

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This study aimed to use the ISI Web of Science (WOS) search engine [3] to investigate the 100 international articles cited most frequently in the field of liver transplantation, to examine these articles in terms of authors and countries, and to research the publication journals.

MATERIALS AND METHODS

Our study is a retrospective observational study. It was completed after receiving permission from Dokuz Eylül University non-interventional ethics committee (decision no. 2015/19-08).

Using the advanced mode of the ISI WOS search engine, the words "SU = transplantation AND TI = liver OR SU = transplantation AND TS = liver" were used to scan articles published from 1975 to date in the area of liver transplantation and determine the most-cited 100 articles on July 18, 2016 [3]. The study type was determined as randomized controlled study, prospective study, retrospective study, experimental study, letter to the editor, or case report. Articles with authors listed as the first author on more than one article, organizations with more than one entry, and journals with the most citations were taken from the list. The country, department, and organization of the first authors were determined from communication information. The relationship of the study to liver transplantation was determined according to the following criteria: related to liver transplantation surgery, immunology, pathology, or epidemiology, and assessed separately by two experienced liver transplantation surgeons. Articles that did not abide by these criteria were excluded. A list of the top 100 articles was made. On the list authors who were first author were checked one-by-one to see if they were listed as authors in other articles on the list. Accordingly a table was made listing first-named authors for the top 100 articles in terms of how many times their names appeared on the list from higher to lower (Table 1). Similarly tables were constructed based on organizations and journals listed at least twice in the list (Tables 2 and 3).

Statistical Analysis

The statistical investigation of the data obtained in the research was analyzed using SPSS 15.0 (Statistical Package for Social Sciences, Chicago, Ill, United States). Frequency data are given as number (n) and percentage (%), whereas continuous values are given as mean ± standard deviation. For statistical analysis the Mann-Whitney *U* test, Kruskal-Wallis test, and *t* test were used. A *P* value <.05 was accepted as a significant difference.

RESULTS

From 1975 to the present day, it appears a total of 43,369 articles were published in the field of liver transplantation in the WOS. The article with the most citations had 677 citations, whereas the article with the least citations had 180. The mean citation for the 100 articles was 252.31 ± 96.75.

The mean annual citation number for the articles varied from 61.55 to 5 and the mean was 15.31 ± 8.63. The most-cited article was by Feng et al "Characteristics Associated With Liver Graft Failure: The Concept of a Donor Risk Index" published in the *American Journal of Transplantation* (677 citations). The second most-cited article was by Ploeg et al "Risk-Factors For Primary Dysfunction After Liver-Transplantation - A Multivariate-Analysis" published in *Transplantation* (668 citations) The third most-cited article was by Clavien et al "Preservation and Reperfusion Injuries In Liver Allografts - An Overview and Synthesis of Current Studies" published in *Transplantation* (666 citations).

When the authors listed as first names on the articles were assessed, Marcos A appeared 5 times as the first name, Gonwa TA had four articles, Yao FY had three article, Freeman RB had two articles, Krowka MJ had two articles, Rayes N had two articles, Suziki S had two articles, Wachs ME had two articles, and Wiesner RH had two articles. The other authors on the list were first names on one article.

The three journals that appeared most frequently in the top 100 were *Transplantation* (n = 54), *Liver Transplantation* (n = 25), and *American Journal of Transplantation* (n = 13). Of the journals in the top 100, 87% were listed in the Science Citation index (SCI) and 13% were listed in the Science Citation Index - Expanded (SCI-E). The top three countries listed as communication addresses for authors were USA (n = 76), Germany (n = 10), and Japan (n = 4). Of the authors, 82% listed addresses on the continent of Europe and 18% listed addresses outside the continent of Europe.

When the year of publication was assessed, the greatest number of articles in the top 100 most-cited articles were 37 articles published from 2000–2004, with 20 from 1995–1999, and 14 published in each interval from 1990–1994 and 2005–2009.

When the branch listed for the first authors was evaluated, 69% of authors were in surgical branches and 31% were in nonsurgical branches.

When the type of study was assessed, 42 were prospective, 25 were retrospective, 13 were reviews, 8 were experimental, 5 were case series, 3 were meta-analysis, 2 were guidelines with 1 in vitro study, and 1 was a study designed as both prospective and retrospective.

When the total number of citations and mean annual number of citations for the studies listed in the top 100 most-cited studies in the field of transplantation were analyzed according to year, there was a significant difference in the annual number of citations according to year ($P < .001$). When the annual citation numbers for journals in the SCI and those in the SCI-E indices were assessed, interestingly, the mean annual number of citations for studies published in SCI-E journals was found to be significantly higher than those published in SCI journals ($P < .001$).

There was no significant correlation found between the continent and country of authors and the total number of citations and mean annual number of citations.

When the text type of studies was investigated, there was a significant difference in mean total number of citations and mean annual number of citations ($P < .05$).

When the branches of first authors in the articles included in our study were investigated from the communication address, there was no significant difference in total number of citations and annual number of citations found.

When the scientific articles included in our study were investigated in terms of journal, there was a significant difference in terms of mean annual number of citations ($P < .001$).

Table 1. First Authors of the 100 Articles With the Most Citations in the Field of Liver Transplantation

Name	Number	%
Marcos A	5	5.0
Gonwa TA	4	4.0
Yao FY	3	3.0
Freeman RB	2	2.0
Krowka MJ	2	2.0
Rayes N	2	2.0
Suzuki S	2	2.0
Wachs ME	2	2.0
Wiesner RH	2	2.0
Abt P	1	1.0
Adam R	1	1.0
Aguado JM	1	1.0
Alexander JW	1	1.0
Bechstein WO	1	1.0
Bilir BM	1	1.0
Buell JF	1	1.0
Busuttil RW	1	1.0
Caldwell-Kenkel JC	1	1.0
Carrión JA	1	1.0
Casavilla A	1	1.0
Clavien PA	1	1.0
Contos MJ	1	1.0
Cox KL	1	1.0
Crippin JS	1	1.0
D'Alessandro AM	1	1.0
Dahm F	1	1.0
Davies HS	1	1.0
Dew MA	1	1.0
Dummer JS	1	1.0
Feng S	1	1.0
Fisher NC	1	1.0
Fisher RA	1	1.0
Furukawa H	1	1.0
Graziadei IW	1	1.0
Greig PD	1	1.0
Habibullah CM	1	1.0
Heisel O	1	1.0
Humar A	1	1.0
Inomata Y	1	1.0
Iwatsuki S	1	1.0
Jamieson NV	1	1.0
Kamada N	1	1.0
Kamiike W	1	1.0
Kiuchi T	1	1.0
Kotton CN	1	1.0
Kowalski RJ	1	1.0
Lee S	1	1.0
Lerut J	1	1.0
Lu L	1	1.0
Marsman WA	1	1.0
Martínez-Llordella M	1	1.0
Mazariegos GV	1	1.0
McDiarmid SV	1	1.0
McGory RW	1	1.0
McKeown CM	1	1.0
Meier-Kriesche HU	1	1.0
Merion RM	1	1.0
Meyer CG	1	1.0
Miller LW	1	1.0
Mor E	1	1.0
Neumann UP	1	1.0
Opelz G	1	1.0
Otto G	1	1.0
Pawlik TM	1	1.0
Platz KP	1	1.0
Ploeg RJ	1	1.0
Rambhatla L	1	1.0
Roayaie S	1	1.0
Roberts MS	1	1.0
Russo MW	1	1.0
Schiodt FV	1	1.0
Shakil AO	1	1.0
Stange J	1	1.0
Strom SC	1	1.0
Sussman NL	1	1.0
Terasaki PI	1	1.0
Thuluvath PJ	1	1.0
Thurman RG	1	1.0
Tilney NL	1	1.0
Tzakis AG	1	1.0
Uemoto S	1	1.0
Vauthey JN	1	1.0
Wajszczuk CP	1	1.0
Yamaoka Y	1	1.0
Yerdel MA	1	1.0
Total	100	100.0

DISCUSSION

The ISI is an organization based in the United States. Begun under the leadership of Garfield, it has taken its current form. The basic duties of the ISI are to determine the journals to be included in an index and to periodically check these journals, because the ISI does not index all journals publishing scientific articles. Only journals that abide by quality standards and/or preserve these standards are chosen. Additionally the ISI provides a bibliographic database service specializing in citations and indexing. It includes correct information relating to articles published since 1945. It is possible to access this database using the WOS search engine to obtain information like academic citation analysis and citation indices [1,4,5].

The number of times a scientific article is cited in other publications is an approximate measure of the impact of the work in that field. No previous bibliometric study has evaluated liver transplantation subspecialty fields. This is the first bibliometric study conducted for the subspeciality of liver transplantation. We evaluated the characteristics of highly cited studies in liver transplantation; however, because such articles often have a greater number of total citations, the annual citation rate was also studied. The number of citations indicates the number of times the article has been cited in subsequent publications [6]. It depends on

Table 2. The 100 Articles With the Most Citations in the Field of Liver Transplantation and Citation Rates

Number	Article	Year	Authors	Number of Citations	Mean Citations
1	Characteristics associated with liver graft failure: the concept of a donor risk index. Am J Transplant 6:783–90.	2006	Feng S, Goodrich NP, Bragg-Gresham JL, et al	677	61.55
2	Risk-factors for primary dysfunction after liver-transplantation - a multivariate-analysis. Transplantation 55:807–13.	1993	Ploeg RJ, D'Alessandro AM, Knechtle SJ, et al	668	27.83
3	Preservation and reperfusion injuries in liver allografts. An overview and synthesis of current studies. Transplantation 53:957–78.	1992	Clavien PA, Harvey PR, Strasberg SM, et al	666	26.64
4	Impact of graft size mismatching on graft prognosis in liver transplantation from living donors. Transplantation 27;67:321–7.	1999	Kiuchi T, Kasahara M, Uryuhara K, et al	522	29.00
5	Lymphomas after solid organ transplantation: a collaborative transplant study report. Am J Transplant 4:222–30.	2004	Opelz G, Döhler B	475	36.54
6	MELD and PELD: application of survival models to liver allocation. Liver Transplant 7:567–80.	2001	Wiesner RH, McDiarmid SV, Kamath PS, et al	430	26.88
7	Sinusoidal lining cell-damage - the critical injury in cold preservation of liver allografts in the rat. Transplantation 46:178–91.	1988	Mckeown CM, Edwards V, Phillips MJ, et al	412	14.21
8	Neutrophil infiltration as an important factor in liver ischemia and reperfusion injury. Modulating effects of FK506 and cyclosporine. Transplantation 55:1265–72.	1993	Suzuki S, Toledo-Pereyra LH, Rodriguez FJ, et al	381	15.88
9	The survival benefit of liver transplantation. Am J Transplant 5:307–13.	2005	Merion RM, Schaubel DE, Dykstra DM, et al	362	30.17
10	Humoral theory of transplantation. Am J Transplant 3(6):665–73.	2003	Terasaki PI.	352	25.14
11	The new liver allocation system: moving toward evidence-based transplantation policy. Liver Transplant 8:851–8.	2002	Freeman RB, Wiesner RH, Harper A, et al	339	22.60
12	Clinical presentation of hepatic artery thrombosis after liver transplantation in the cyclosporine era. Transplantation 40:667–71.	1985	Tzakis AG, Gordon RD, Shaw BW, et al	325	10.16
13	The utility of marginal donors in liver transplantation. Liver Transplant 9:651–63.	2003	Busuttil RW, Tanaka K	324	23.14
14	Hepatocyte transplantation as a bridge to orthotopic liver transplantation in terminal liver failure. Transplantation 27;63:559–69.	1997	Strom SC, Fisher RA, Thompson MT, et al	318	15.90
15	International Consensus Guidelines on the Management of Cytomegalovirus in Solid Organ Transplantation. Transplantation 15;89:779–95	2010	Kotton CN, Kumar D, Caliendo AM, et al	298	42.57
16	End-stage renal disease (ESRD) after orthotopic liver transplantation (OLTX) using calcineurin-based immunotherapy - risk of development and treatment. Transplantation 27;72:1934–9.	2001	Gonwa TA, Mai ML, Melton LB, et al	287	17.94
17	Right lobe living: donor liver transplantation. Transplantation 27;68:798–803.	1999	Marcos A, Fisher RA, Ham JM, et al	287	15.94
18	Chronic rejection–an undefined conundrum. Transplantation 52:389–98.	1991	Tilney NL, Whitley WD, Diamond JR, et al	287	11.04
19	Right lobe graft in living donor liver transplantation. Transplantation 27;69:258–64.	2000	Inomata Y, Uemoto S, Asonuma K, et al	277	16.29
20	Preservation of the canine liver for 24-48 hours using simple cold storage with UW solution. Transplantation 46:517–22.	1988	Jamieson NV, Sundberg R, Lindell S, et al	277	9.55
21	Early infections in kidney, heart, and liver transplant recipients on cyclosporine. Transplantation 36:259–67.	1983	Dummer JS, Hardy A, Poorsattar A, et al	275	8.09
22	Immunosuppression: evolution in practice and trends, 1994-2004. Am J Transplant 6:1111–31	2006	Meier-Kriesche HU, Li S, Gruessner RWG, et al	270	24.55
23	The risk of transmission of hepatitis B from HBsAg(-), HBcAb(+), HBIgM(-) organ donors. Transplantation 7;59:230–4.	1995	Wachs ME, Amend WJ, Ascher NL, et al	270	12.27

24	Generation of hepatocyte-like cells from human embryonic stem cells. Cell Transplant 12:1–11.	2003	Rambhatla L, Chiu CP, Kundu P, et al	268	19.14
25	Impact of pretransplant renal function on survival after liver transplantation. Transplantation 5;59:361–5.	1995	Gonwa TA, Klintmalm GB, Levy M, et al	266	12.09
26	Chemoembolization followed by liver transplantation for hepatocellular carcinoma impedes tumor progression while on the waiting list and leads to excellent outcome. Liver Transplant 9:557–63.	2003	Graziadei IW, Sandmueller H, Waldenberger P, et al	264	18.86
27	The predictive value of donor liver biopsies on the development of primary nonfunction after orthotopic liver transplantation. Transplantation 51(1):157–63.	1991	D'Alessandro AM, Kalayoglu M, Sollinger HW, et al	261	10.04
28	Report of the First International Liver Transplantation Society Expert Panel Consensus Conference on Liver Transplantation and Hepatitis C. Liver Transplant 9:S1–9.	2003	Wiesner RH, Sorrell M, Villamil F, et al	257	18.36
29	Weaning of immunosuppression in liver transplant recipients. Transplantation 27;63:243–9.	1997	Mazariegos GV, Reyes J, Marino IR, et al	250	12.50
30	Malignancy after transplantation. Transplantation 15;80:254–64.	2005	Buell JF, Gross TG, Woodle ES, et al	249	20.75
31	Liver transplantation for hepatocellular carcinoma: comparison of the proposed UCSF criteria with the Milan criteria and the Pittsburgh modified TNM criteria. Liver Transplant 8:765–74.	2002	Yao FY, Ferrell L, Bass NM, et al	247	16.47
32	Neurotoxicity of calcineurin inhibitors: impact and clinical management. Transplant Int 13:313–26.	2000	Bechstein WO	246	14.47
33	Small-for-size syndrome after partial liver transplantation: definition, mechanisms of disease and clinical. Am J Transplant 5:2605–10.	2005	Dahm F, Georgiev P, Clavien PA, et al	242	20.17
34	Results of the first year of the new liver allocation plan. Liver Transplant 10(1):7–15.	2004	Freeman RB, Wiesner RH, Edwards E, et al	242	18.62
35	Tumor size predicts vascular invasion and histologic grade: implications for selection of surgical treatment for hepatocellular carcinoma. Liver Transplant 11:1086–92.	2005	Pawlik TM, Delman KA, Vauthey JN, et al	238	19.83
36	Liver transplantation for hepatocellular carcinoma: analysis of survival according to the intention-to-treat principle and dropout from the waiting list. Liver Transplant 8:873–83.	2002	Yao FY, Bass NM, Nikolai B, et al	237	15.80
37	Biliary-tract complications in human orthotopic liver-transplantation. Transplantation 43:47–51.	1987	Lerut J, Gordon RD, Iwatsuki S, et al	237	7.90
38	Experience with liver and kidney allografts from non-heart-beating donors. Transplantation 27;59:197–203.	1995	Casavilla A, Ramirez C, Shapiro R, et al	236	10.73
39	Treatment of primary liver graft nonfunctıon with Prostaglandın-E1. Transplantation 48:447–53.	1989	Greig PD, Woolf GM, Sinclair SB, et al	235	8.39
40	A novel immunosuppressant, FTY720, with a unique mechanism of action, induces long-term graft acceptance in rat and dog allotransplantation. Transplantation 27;61(2):200–5.	1996	Suzuki S, Enosawa S, Kakefuda T, et al	233	11.10
41	Human hepatocyte transplantation: worldwide results. Transplantation 27;82:441–9.	2006	Fisher RA, Storm SC	231	21.00
42	The use of marginal donors for organ-transplantation - the influence of donor age on outcome. Transplantation 51:135–41.	1991	Alexander JW, Vaughn WK	231	8.88

Table 2. (continued)

Number	Article	Year	Authors	Number of Citations	Mean Citations
43	Pulmonary hemodynamics and perioperative cardiopulmonary-related mortality in patients with portopulmonary hypertension undergoing liver transplantation. Liver Transplant 6:443–50.	2000	Krowka MJ, Plevak DJ, Findlay JY, et al	226	13.29
44	Etiology and outcome for 295 patients with acute liver failure in the United States. Liver Transplant Surg 5:29–34.	1999	Schiodt FV, Atillasoy E, Shakil AO, et al	226	12.26
45	Early enteral supply of lactobacillus and fiber versus selective bowel decontamination: a controlled trial in liver transplant recipients. Transplantation 15;74:123–7.	2002	Rayes N, Seehofer D, Hansen S, et al	226	15,07
46	Experience in 1,000 liver-transplants under cyclosporine-steroid therapy - a survival report. Transplant Proc 20:498–504.	1988	Iwatsuki S, Starzl TE, Todo S, et al	226	7.79
47	Adenine-nucleotide metabolism and its relation to organ viability in human-liver transplantation. Transplantation 45:138–43.	1988	Kamiike W, Burdelski M, Steinhoff G, et al	225	7.76
48	Molecular adsorbent recycling system (MARS): clinical results of a new membrane-based blood purification system for bioartificial liver support. Artif Organs 23:319–30.	1999	Stange J, Mitzner SR, Risler T, et al	224	12.44
49	Transient elastography for diagnosis of advanced fibrosis and portal hypertension in patients with hepatitis C recurrence after liver transplantation. Liver Transplant 12:1791–8.	2006	Carrion JA, Navasa M, Bosch J, et al	221	20.09
50	Chronic renal failure following liver transplantation - a retrospective analysis. Transplantation 15;66:59–66.	1998	Fisher NC, Nightingale PG, Gunson BK, et al	221	11.58
51	Bone marrow-derived dendritic cell progenitors (NLDC 145+, MHC class II+, B7-1dim, B7-2-) induce alloantigen-specific hyporesponsiveness in murine T lymphocytes. Transplantation 27;60:1539–45.	1995	Lu L, McCaslin D, Starzl TE, Thomson AW	220	10
52	Improved outcome of orthotopic liver transplantation for chronic hepatitis B cirrhosis with aggressive passive immunization. Transplantation 15;61:1358–64.	1996	McGory RW, Ishitani MB, Oliveira WM, et al	218	10.38
53	Hepatic reperfusion injury following orthotopic liver-transplantation in the rat. Transplantation 46:502–6.	1988	Thurman RG, Marzi I, Seitz G, et al	218	7.52
54	Long-term survival and renal-function following liver-transplantation in patients with and without hepatorenal-syndrome - experience in 300 patients. Transplantation 51:428–30.	1991	Gonwa TA, Morris CA, Goldstein RM, et al	216	8.31
55	The hepatix extracorporeal liver assist device - initial clinical-experience. Artif Organs 18:390–6.	1994	Sussman NL, Gislason GT, Conlin CA, et al	215	9.35
56	Fungal-infections in liver-transplant recipients. Transplantation 40:347–53.	1985	Wajszczuk CP, Dummer JS, Ho M, et al	215	6.72
57	American Society of Transplantation recommendations for screening, monitoring and reporting of infectious complications in immunosuppression trials in recipients of organ transplantation. Am J Transplant 6:262–74.	2006	Humar A, Michaels M, AST ID Working Group on Infectious Disease Monitoring	214	19.45
58	New onset diabetes mellitus in patients receiving calcineurin inhibitors: a systematic review and meta-analysis. Am J Transplant 4:583–95.	2004	Heisel O, Heisel R, Balshaw R, et al	214	16.44
59	Acute liver failure: clinical features, outcome analysis, and applicability of prognostic criteria. Liver Transplant 6:163–9.	2000	Shakil AO, Kramer D, Mazariegos GV, et al	213	12.53

60	A pilot study of the tolerability and efficacy of antiviral therapy in hepatitis C virus-infected patients awaiting liver transplantation. Liver Transplant 8:350–5.	2002	Crippin JS, McCashland T, Terrault N, et al	212	14.13
61	Body surface area, liver tranplatation 2002. Liver Transplant 8:233–40.	2002	Vauthey JN, Abdalla EK, Doherty DA, et al	211	14.00
62	Cardivascular toxicities of immunosuppressive agents. Am J Transplant 2:807–18.	2002	Miller LW	210	14
63	Adult living donor liver transplantation using a right hepatic lobe. Transplantation 27;66:1313–6.	1998	Wachs ME, Bak TE, Karrer FM, et al	210	11.05
64	Liver transplantation for cholangiocarcinoma: results in 207 patients. Transplantation 27;69(8):1633–7.	2000	Meyer CG, Penn I, James L	209	12.29
65	Does transplantation produce quality of life benefits? A quantitative analysis of the literature. Transplantation 15;64:1261–73.	1997	Dew MA, Switzer GE, Goycoolea JM, et al	209	10.45
66	The outcome of steatotic grafts in liver-transplantation. Transplant Proc 23:1538–40.	1991	Adam R, Reynes M, Johann M, et al	209	8.04
67	Supply of pre- and probiotics reduces bacterial infection rates after liver transplantation - a randomized, double-blind trial. Am J Transplant 5:125–30.	2005	Rayes N, Seehofer D, Theruvath T, et al	208	17.33
68	Hepatocyte transplantation in acute liver failure. Liver Transplant 6:32–40.	2000	Bilir BM, Guinette D, Karrer F, et al	205	12.06
69	The use of marginal donors for liver-transplantation - a retrospective study of 365 liver-donors. Transplantation 53:383–6.	1992	Mor E, Klintmalm GB, Gonwa TA, et al	204	8.16
70	Selective loss of nonparenchymal cell viability after cold ischemıc storage of rat livers. Transplantation 45:834–7.	1988	Caldwellkenkel JC, Thurman RG, Lemasters JJ	203	7.00
71	Estimation of glomerular filtration rates before and after orthotopic liver transplantation: evaluation of current equations. Liver Transplant 10:301–9.	2004	Gonwa T, Jennings L, Mai ML, et al	202	15.54
72	Soluble HLA antigens in the circulatıon of liver graft recipients. Transplantation 47(3):524–7.	1989	Davies HS, Pollard SG, Calne RY	201	7.18
73	Response to transarterial chemoembolization as a biological selection criterion for liver transplantation in hepatocellular carcinoma. Liver Transplant 12:1260–7.	2006	Otto G, Herber S, Heise M, et al	200	18.18
74	An increased incidence of Epsteın-Barr-virus infection and lymphoproliferative disorder in young-children on fk506 after liver-transplantation. Transplantation 27;59:524–9	1995	Cox KL, Lawrencemiyasaki LS, Garciakennedy R, et al	200	9.09
75	Portal vein thrombosis in adults undergoing liver transplantation - risk factors, screening, management, and outcome. Transplantation 15;69:1873–81.	2000	Yerdel MA, Gunson B, Mirza D, et al	199	11.71
76	Single-center analysis of the first 40 adult-to-adult living donor liver transplants using the right lobe. Liver Transplant 6:296–301.	2000	Marcos A, Ham JM, Fisher RA, et al	199	11.71
77	Liver-transplantation using a right lobe graft from a living-related donor. Transplantation 57:1127–1130	1994	Yamaoka Y, Washida M, Honda K, et al	197	8.57
78	Recurrence of hepatocellular carcinoma after liver transplant: patterns and prognosis. Liver Transplant 10:534–40.	2004	Roayaie S, Schwartz JD, Sung MW, et al	197	11.15
79	Liver regeneration and function in donor and recipient after right lobe adult to adult living donor liver transplantation. Transplantation 15;69:1375–9.	2000	Marcos A, Fisher RA, Ham JM, et al	196	11.53
80	Assessing relative risks of infection and rejection: a meta-analysis using an immune function assay. Transplantation 15;82:663–8.	2006	Kowalski RJ, Post DR, Mannon RB, et al	195	17.73

Table 2. (continued)

Number	Article	Year	Authors	Number of Citations	Mean Citations
81	Clinical presentation and outcome of tuberculosis in kidney, liver, and heart transplant recipients in Spain. Transplantation 15;63:1278–86.	1997	Aguado JM, Herrero JA, Gavalda J, et al	195	9.75
82	Multiparameter immune profiling of operational tolerance in liver transplantation. Am J Transplant 7:309–19.	2007	Martinez-Llordella M, Puig-Pey I, Orlando G, et al	194	19.40
83	Liver transplantation for acute liver failure from drug induced liver injury in the United States. Liver Transplant 10:1018–23.	2004	Russo MW, Galanko JA, Shrestha R, et al	194	14.92
84	Hepatopulmonary syndrome and portopulmonary hypertension: a report of the multicenter liver transplant database. Liver Transplant 10:174–82.	2004	Krowka MJ, Mandell MS, Ramsay MAE, et al	194	14.92
85	Long-term outcome of liver transplants for chronic hepatitis C: a 10-year follow-up. Transplantation 27;77:226–31.	2004	Neumann UP, Ber T, Bahra M, et al	194	14.92
86	Survival after liver transplantation in the United States: a disease-specific analysis of the UNOS database. Liver Transplant 10:886–97.	2004	Roberts MS, Angus DC, Bryce CL, et al	193	14.85
87	Prevention and preemptive therapy of posttransplant lymphoproliferative disease in pediatric liver recipients. Transplantation 27;66:1604–11.	1998	McDiarmid SV, Jordan S, Lee GS, et al	193	10.16
88	Nephrotoxicity following orthotopic liver-transplantation - a comparison between cyclosporine and fk506. Transplantation 27;58:170–8.	1994	Platz KP, Mueller AR, Blumhardt G, et al	192	8.35
89	Use of fatty donor liver is associated with diminished early patient and graft survival. Transplantation 15;62:1246–51.	1996	Marsman WA, Wiesner RH, Rodriguez L, et al	191	9.10
90	Congestion of right liver graft in living: donor liver transplantation. Transplantation 27;71:812–4.	2001	Lee S, Park K, Hwang S, et al	190	11.88
91	Right lobe living donor liver transplantation. Liver Transplant 6:3–20.	2000	Marcos A	190	11.18
92	Orthotopic rat liver transplantation after long-term preservation by continuous perfusion with fluorocarbon emulsion. Transplantation 30:43–8.	1980	Kamada N, Calne RY, Wight DG, Lines JG	188	5.0
93	Liver transplantation for hepatocellular carcinoma: validation of the UCSF-expanded criteria based on preoperative imaging. Am J Transplant 7:2587–96.	2007	Yao FY, Xiao L, Bass NM; et al	187	18.70
94	Cold ischemia time vs outcome of human liver transplantation using UW solution. Transplant Proc 23:1550–1.	1991	Furukawa H, Todo S, Imventarza O, et al	185	7.12
95	Liver transplantation in the United States, 1999–2008. Am J Transplant 10:1003–19.	2010	Thuluvath PJ, Guidinger MK, Fung JJ, Johnson LB, et al	184	26.92
96	The interrelationship between portal and arterial blood flow after adult to adult living donor liver transplantation. Transplantation 27;70:1697–703.	2000	Marcos A1, Olzinski AT, Ham JM, Fisher RA, Posner MP	183	10.00
97	Liver transplantation from controlled non-heart-beating donors: an increased incidence of biliary complications. Transplantation 27;75:1659–63.	2003	Abt P, Crawford M, Desai N, et al	181	12.93
98	Human fetal hepatocyte transplantation in patients with fulminant hepatic failure. Transplantation 27;58:951–2.	1994	Habibullah CM, Syed IH, Qamar A, Taher-Uz Z	181	7.87
99	Development of nonalcoholic fatty liver disease after orthotopic liver transplantation for cryptogenic cirrhosis. Liver Transplant 7:363–73.	2001	Contos MJ, Cales W, Sterling RK, et al	180	11.25
100	Transmission of hepatitis B virus from hepatitis B core antibody-positive donors in living related liver transplants Transplantation 65:494–499	1998	Uemoto S, Sugiyama K, Marusawa H, et al	180	9.47

Table 3. Characteristics of 100 Articles With Most Citations in the Field of Liver Transplantation

	Subgroup	n	Total Number of Citations Mean ± SD	Annual Number of Citations Mean ± SD	Total Citations *P*	Annual Citations *P*
Article year	<1990	13	249.00 ± 61.58	10.53 ± 9.88	.919	<.001
	1990–1994	14	292.35 ± 167.10	11.75 ± 6.91		
	1995–1999	20	243.40 ± 74.25	12.14 ± 4.41		
	2000–2004	37	239.54 ± 67.70	15.91 ± 5.33		
	2005–2009	14	263.42 ± 127.05	23.45 ± 11.45		
	>2010	2	241.00 ± 80.61	34.74 ± 11.06		
Journal index	SCI	87	246.45 ± 87.10	13.80 ± 6.81	.542	<.001
	SCI-E	13	291.46 ± 144.75	25.38 ± 12.51		
Author continent	Europe	18	229.61 ± 64.52	14.60 ± 7.31	.294	.833
	Outside Europe	82	257.29 ± 102.12	15.46 ± 8.93		
Author country	USA	76	257.25 ± 100.29	15.60 ± 9.03	.400	.456
	Germany	10	240.80 ± 83.97	14.98 ± 8.58		
	Japan	4	294.00 ± 157.77	15.83 ± 9.43		
	Spain	3	203.33 ± 15.30	16.03 ± 6.11		
	UK	2	200.00 ± 1.41	9.00 ± 2.82		
	Austria	1	264.00	18.86		
	Switzerland	1	242.00	20.17		
	France	1	209.00	8.00		
	South Korea	1	190.00	11.00		
	India	1	181.00	7.87		
Type of text	Guideline	2	256.00 ± 59.39	31.01 ± 16.34	.027	.004
	Review	13	279.00 ± 66.28	19.43 ± 5.30		
	In vitro study	1	268.00	19.14		
	Retrospective	25	283.32 ± 157.67	17.42 ± 13.03		
	Meta-analysis	3	206.00 ± 9.84	14.88 ± 3.88		
	Prospective clinical	42	234.00 ± 59.78	13.75 ± 5.45		
	Case series	5	196.60 ± 11.58	10.09 ± 1.77		
	Experimental	8	266.50 ± 84.70	9.95 ± 3.71		
	Retrospective + Prospective	1	180.00	9.47		
Branch of researchers	Surgical	69	259.20 ± 104.38	15.06 ± 8.85	.200	.460
	Nonsurgical	31	236.96 ± 76.45	15.86 ± 8.24		
Journals	Am J Transplant	13	291.46 ± 144.75	25.38 ± 12.51	.881	<.001
	Cell Transplant	1	268.00	19.14		
	Liver Transplant	25	233.64 ± 56.39	16.10 ± 4.10		
	Transplant Int	1	246.00	14.47		
	Transplantation	54	255.40 ± 102.79	13.14 ± 7.83		
	Artif Organ	2	219.50 ± 6.36	10.89 ± 2.18		
	Transplant Proc	4	214.00 ± 22.31	8.41 ± 1.59		

Abbreviation: SD, standard deviation.

both the article topic and the influence it has on the work of other authors (who cite it in their own publications). However, the number of citations and the impact factor of the journal of publication do not always indicate the quality of the original article. Indeed, both the author name(s) and journal of publication may significantly influence the number of citations.

Google Scholar or WOS can be used to determine how often an article has been cited so that bibliographic studies can be performed. Because non-English articles are included in Google Scholar, it has a wider range of citations than WOS [7,8]. We evaluated only English articles. For this reason, the 100 most-cited articles were determined based on data provided by WOS. However, in determining the number of citations, including only articles published in medical journals may not be adequate in reflecting current trends. Google Scholar is able to scan additional conference proceedings, and the WOS includes nonconventional citations in online documents, university theses, and websites. We used WOS in this study, and we aimed to determine the most-cited articles in the liver tranplantation field of general surgery and to identify current areas of interest. These parameters can also be used to determine the most popular articles on any topic. For this reason, we evaluated the total number of citations, as obtained from WOS.

In this study there were seven journals with the most citations in the field of liver transplantation: *American Journal of Transplantation*, *Cell Transplantation*, *Transplantation International*, *Transplantation*, *Liver Transplantation*, *Transplantation Proceedings*, and *Artificial Organs*. There was a significant difference determined between the journals that published the 100 studies with the

most citations included in our study and mean annual number of citations. The mean annual citations of articles published in the journal *American Journal of Transplantation* was significantly higher than other journals.

Of articles included in our study, 87% were indexed in SCI and 13% were indexed in SCI-E. However, contrary to expectations, the mean annual citations of articles in the top 100 articles list published in journals indexed in the SCI-E were determined to be higher than those in journals indexed in the SCI index.

It is possible to find a variety of publications with the aim of identifying articles with the most citations in a variety of medical branches both at home and abroad and in varying clinics and surgical branches [9–13]. The top 100 articles in terms of citations globally have been researched and published for a variety of fields like emergency medicine [14], anesthesiology and intensive care [15], radiology [16], eye surgery [13], cardiac surgery [17], otolaryngology-head and neck surgery [6], and orthopedics [18].

As in other areas, bibliographic articles have been published in the field of general surgery. These include studies on gastrointestinal system diseases like digestive system disease [19], gastric cancers [20], and gastroenterology and hepatology articles [21], as well as studies including specific surgical topics like bariatric surgery [9] and colorectal cancer [22].

In our study we evaluated the 100 articles with the most international citations in the field of "liver transplantation." Of these articles, 69% were authored primarily by general surgery physicians, whereas 31% were authored primarily by non–general surgery physicians. In our investigation in the field of "liver transplantation," the article with the most citations was cited 677 times, whereas the article with the least citations was cited 180 times. The mean citation number for the 100 articles was 252.31 ± 96.75. The mean annual number of citations for these articles varied from 61.55 to 5 with a mean of 15.31 ± 8.63. The most-cited article was by Feng et al "Characteristics Associated With Liver Graft Failure: The Concept of a Donor Risk Index" published in the *American Journal of Transplantation* (677 citations). The second most-cited article was by Ploeg et al "Risk-Factors For Primary Dysfunction After Liver-Transplantation - A Multivariate-Analysis" published in *Transplantation* (668 citations). The third most-cited article was by Clavien et al "Preservation and Reperfusion Injuries In Liver Allografts - An Overview and Synthesis of Current Studies" published in *Transplantation* (666 citations).

When the types of the studies were assessed, 25 were retrospective, 42 were prospective clinical, and 13 were review. The type of text receiving the most citations was determined to be guideline articles. These were followed by reviews. The types receiving the fewest citations were experimental studies and case series. It is thought that the location of experimental studies and cases series at the bottom of the pyramid of evidence and the location of reviews and guidelines at the top of the pyramid may have affected this result.

Transplantation from a living donor was first attempted in Brazil in 1988, however, the recipient died [23]. After this failure, studies continued rapidly and the first successful liver transplantation was performed in 1990 from an adult to a child by Strong et al in Australia [24]. In the 1990s because transplantation in Asian societies, especially Japan, does not allow transplantation from cadavers to the living, contrary to Western societies, so transplantation is completed from living donors with transplantation from cadavers remaining at very low levels of 5 per million. In Western societies, because there is no limitation on transplantation from cadavers, transplantation occurred at the slightly higher rate of 10–35 per million [25]. Due to the difficulty in finding sufficient cadavers, globally new approaches have been developed due to desperation in finding organs. In Japan in 1993, for the first time, left lobe transplantation was performed by Ichida et al from a living donor adult to another adult and ended in success [26]. To reduce complications of this major operation and to make it more applicable, attempts have been made to improve the surgical technique and the first right lobe transplantation with the central hepatic vein was performed in 1996 [27]. Continuing development with the aim of reducing operation technique complications led to the first successful right lobe transplantation without using the central hepatic vein by Wachs et al in 1997 [28]. As a result of these studies since 1997 the number of transplantations has rapidly increased in Asia, Europe, and North and South America. Liver transplantation has become more applicable and undergone rapid development in the last 16 years and is an indispensible treatment method for patients with end-stage chronic liver disease. However, due to a variety of cultural factors and the social structure of societies, to change the approach of patients and donors to liver transplantation the complications of the applied surgical technique prevent transplantation from being performed at the desired frequency. However, developing surgical technique, intensive care facilities, and immunosuppressive treatment after the operation have ensured a reduction in both donor and patient mortality and morbidity, and, due to being performed at more centers, transplantation has become more common. In our study, the most common three countries in the communication addresses for the first authors of the top 100 most-cited articles were USA (n = 76), Germany (n = 10), and Japan (n = 4). Of the authors, 82% were from outside Europe and 18% were from countries within the continent of Europe. No correlation was found between the countries of the authors and the number of citations. Similarly there was no correlation between the continent of authors and the number of citations.

When publication years of articles in this study were assessed, the highest amount of articles in the top 100 most-cited articles were 37 from the years 2000–2004, followed by 20 from 1995–1999, and 14 each from 1990–1994 and 2005–2009. When this data was investigated, the number of articles in the top 100 most-cited articles was highest from 2000–2004, with progressive reduction in the

5-year periods before and after this period. However, most noteworthy is that as we move toward the present the studies in the top 100 most-cited articles have an increase in the rate of annual number of citations. This result is contrary to expected, with new articles in the rapidly developing field of liver transplantation with advancing medical knowledge and developing technologies receiving more citations than old articles. This result indicates that no matter how the older articles form the cornerstone, scientists, especially in this type of specific and detailed medical surgical branch, like liver transplantation, keep up with current medical knowledge.

It is almost impossible to find sufficient organs for end-stage liver and acute liver failure patients from cadaver transplants. To close this gap, living transplantation has been a life-saver. Immunosuppressive treatment and complications due to the operation should be kept to a minimum and, if possible, treated before they occur. No matter how common and efficient a method liver transplantation from cadavers and living donors is, the latest developments such as entry into use of hepatocyte transplantation and "xenotransplantation" promise to completely solve the problem of patients waiting for organs [29,30].

Like all bibliometric studies, this study has many limitations. First, WOS was used to search for the most-cited articles. The number of citations is known to differ between databases [9]. Finally, although the number of citations and mean annual citation rate are traditional parameters for evaluating the scientific value of an article, its contribution to science cannot be evaluated by these measures alone.

Although there are many bibliographic articles in the field of general surgery, as with a variety of clinical and surgical branches, there is no previous study in the field of liver transplantation. This type of bibliographic study has the potential to be used as a guide to determining the articles with the most citations in the field of liver transplantation. To ensure healthy data, it is recommended that this type of study be updated and rewritten at certain time intervals.

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