Review Article

The one hundred most-cited articles on laparoscopic liver surgery

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Contributions: (I) Conception and design: GB Levi Sandri; (II) Administrative support: G Spoletini; (III) Provision of study materials or patients: GB Levi Sandri; (IV) Collection and assembly of data: GB Levi Sandri; (V) Data analysis and interpretation: GB Levi Sandri; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

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Abstract: The aim of this review was to identify the 100 most-cited articles related to laparoscopic liver resection (LLR), to analyze their trend according to publication year and to summarize the knowledge and evidence these one-hundred articles brought to the surgical community. We performed a search to identify all studies dealing with LLR by utilizing the Institute for Scientific Information (ISI) Web of Science (Thomson Reuters, New York, NY, USA) database. We found 2,018 papers, applying the exclusion criteria on all articles, the 100 most cited articles on LLR were identified. The oldest article was published in 1996 and the most recent in 2015. The 100 articles were published in 23 different journals, 55 articles were published in 3 journals: Surgical Endoscopy [27], Annals of Surgery [20] and British Journal of Surgery [8]. The most frequent first and last authors were Dagher I (5 articles) and Cherqui D (7 articles) respectively. In 30 cases the article was published by a French team and in 18 cases from a USA team. Most frequent topics were: hepatocellular carcinoma (17 articles), liver cysts [9], major hepatectomy [8], left lateral resection [7], colorectal metastases [6], benign diseases [4] and living donor hepatectomies [3]. LLR is worldwide performed and surgical indications are expanding.

Keywords: Laparoscopic liver surgery; minimally invasive surgery; hepatocellular carcinoma; left lateral; 100 top

Received: 28 November 2017; Accepted: 27 December 2017; Published: 29 December 2017.
doi: 10.21037/ls.2017.12.01
View this article at: http://dx.doi.org/10.21037/ls.2017.12.01

Introduction

Since the first laparoscopic liver resection (LLR) was reported in 1992 by Gagner *et al.* (1) at the Scientific Session of the Society of American Gastrointestinal Surgeons, minimally invasive techniques in liver surgery have continued to develop. LLR is worldwide accepted based on the excellent results shown over the years. The number of publications on LLR increase each year and so the citation index. LLR is certainly one of the fields with the greatest expansion in the scientific surgical community. Despite the fast-growing amount of data, it took 16 years before the first international position on laparoscopic liver surgery was released: The Louisville Statement in 2008 (2).

The present study identifies the 100 most-cited articles related to LLR, analyzes the trends in these articles according to publication year and summarizes on the knowledge and evidence these one-hundred articles brought to the surgical community.

Methods

We performed a search to identify all studies dealing with LLR by utilizing the Institute for Scientific Information (ISI) Web of Science (Thomson Reuters, New York, NY, USA) database. The search was performed on 15 November 2016. We searched the following terms either singly or in combination ("Laparoscopy" liver) OR TITLE: ("Laparoscopic" liver) OR TITLE: ("minimally" liver) OR TOPIC: ("Laparoscopy" hcc) OR TOPIC: ("Laparoscopy"

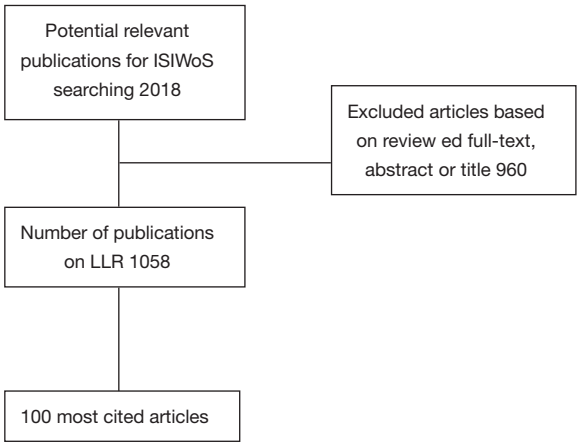

Figure 1 Flow diagram showing the selection process of the 100 most cited articles.

hepatocellular carcinoma) OR TOPIC: ("Laparoscopy" hepatectomy) OR TOPIC: ("Laparoscopy" left lateral) OR TOPIC: ("Laparoscopy" posterior segment); Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.

Inclusion and exclusion criteria

All article types were potentially included (original articles, review articles, case reports and series, systematic reviews/meta-analyses, letters or commentaries). A LLR article was defined by the following inclusion criteria: (I) content about liver surgery; (II) proposing new technique; (III) comparative study; (IV) indications, classifications and guidelines articles. Exclusion criteria were: (I) study on staging by laparoscopy; (II) non-surgical resection study (i.e., ablation or radiofrequency); (III) robotic surgery.

Results

We found 2,018 papers, applying the exclusion criteria on all articles, the 100 most cited articles on LLR were identified (*Figure 1*). The top 100 articles and their associated number of citations are shown in *Table 1*. The number of top 100 articles citations ranged from 34 to 364 with a median of 70 (IQR 49–120) citations.

The oldest article was published in 1996 (ranked 12, 13, 56, 77, 88 and 91th) and the most recent in 2015 (45th). Sixty-one articles were published before the first consensus conference held in Louisville in 2008 (published in 2009). Eighty articles were published between 1990 and 2009. The 100 articles were published in 23 different journals (*Table 2*), 55 articles were published in 3 journals: *Surgical Endoscopy* [27], *Annals of Surgery* [20] and *British Journal of Surgery* [8].

The most frequent first and last authors were Dagher I (5 articles) and Cherqui D (7 articles) respectively. This result is reflected on the origin of the 100 articles: in 30 cases the article was published by a French team and in 18 cases by a USA team. This means that these two countries have contributed to half of the 100 most important articles on LLR. These results are resumed in *Table 3*. The topics of the articles were very heterogeneous in 46 cases (e.g., review, feasibility, consensus, personal experience). Nevertheless, if we look at the remaining 54 articles the main topic was: hepatocellular carcinoma in 17 cases, liver cysts of any kind in 9, major hepatectomies in 8, left lateral resections in 7, colorectal metastases in 6, Bening diseases in 4 and in living donor hepatectomies in 3.

Analyzing the 1,086 articles included in this study, the number of publication grew constantly, with more than 100 publications per year since 2014. The number of citations increased accordingly and it is now of over 2,000 per year (*Figures 2,3*).

Discussion

Laparoscopic liver surgery is out of doubt one of the fastest growing fields in abdominal surgery today. The technical evolution led to the expansion of the indications without jeopardizing the outcomes. The world review of LLR published in 2009 reported a global experience of 2,804 cases (3). That review is actually the most cited article on LLR. The second most cited article is the first International Position on Laparoscopic Liver Surgery (2).

After the release of the Louisville Statement and the first world review, there has been a substantial increase in the number of published articles and citations per year (namely, >80 articles and >1,000 citations) (*Figures 2,3*). Despite this growing interest in the field, we found a mean of only 70 citations per article for the top 100 articles. This is probably due to LLR still being a very specialized topic in hepatic surgery with a limited number of authors publishing about it. Also, most of the authors of the 100 top articles are either from France or USA (*Table 3*), highlighting again that LLR is performed, especially at high volumes, only in a few centers. Nevertheless, all continents are represented with at least one country in the top 100 articles as to show that

Table 1 The top-100 cited articles on laparoscopic liver surgery

N	Article (authors. title. journal)	Country	Citations
1	Nguyen KT, Gamblin TC, Geller DA. World review of laparoscopic liver resection-2,804 patients. *Ann Surg* 2009;250:831-41.	USA	364
2	Buell JF, Cherqui D, Geller DA, *et al.* The international position on laparoscopic liver surgery: The Louisville Statement, 2008. *Ann Surg* 2009;250:825-30.	USA	352
3	Cherqui D, Husson E, Hammoud R, *et al.* Laparoscopic liver resections: a feasibility study in 30 patients. *Ann Surg* 2000;232:753-62.	France	313
4	Koffron AJ, Auffenberg G, Kung R, *et al.* Evaluation of 300 minimally invasive liver resections at a single institution: less is more. *Ann Surg* 2007;246:385-92; discussion 392-4.	USA	260
5	Gigot JF, Glineur D, Santiago Azagra J, *et al.* Laparoscopic liver resection for malignant liver tumors: preliminary results of a multicenter European study. *Ann Surg* 2002;236:90-7.	Belgium	242
6	Vibert E, Perniceni T, Levard H, *et al.* Laparoscopic liver resection. *Br J Surg* 2006;93:67-72.	France	213
7	Lesurtel M, Cherqui D, Laurent A, *et al.* Laparoscopic versus open left lateral hepatic lobectomy: a case-control study. *J Am Coll Surg* 2003;196:236-42.	France	201
8	Kaneko H, Takagi S, Otsuka Y, *et al.* Laparoscopic liver resection of hepatocellular carcinoma. *Am J Surg* 2005;189:190-4.	Japan	181
9	Cherqui D, Laurent A, Tayar C, *et al.* Laparoscopic liver resection for peripheral hepatocellular carcinoma in patients with chronic liver disease: midterm results and perspectives. *Ann Surg* 2006;243:499-506.	France	180
10	Laurent A, Cherqui D, Lesurtel M, *et al.* Laparoscopic liver resection for subcapsular hepatocellular carcinoma complicating chronic liver disease. *Arch Surg* 2003;138:763-9; discussion 769.	France	180
11	Buell JF, Thomas MT, Rudich S, *et al.* Experience with more than 500 minimally invasive hepatic procedures. *Ann Surg* 2008;248:475-86.	USA	179
12	Kaneko H, Takagi S, Shiba T. Laparoscopic partial hepatectomy and left lateral segmentectomy: technique and results of a clinical series. *Surgery* 1996;120:468-75.	Japan	169
13	Azagra JS, Goergen M, Gilbart E, *et al.* Laparoscopic anatomical (hepatic) left lateral segmentectomy-technical aspects. *Surg Endosc* 1996;10:758-61.	Belgium	166
14	Morino M, Morra I, Rosso E, *et al.* Laparoscopic vs open hepatic resection: a comparative study. *Surg Endosc* 2003;17:1914-8.	Italy	163
15	Dagher I, O'Rourke N, Geller DA, *et al.* Laparoscopic major hepatectomy: an evolution in standard of care. *Ann Surg* 2009;250:856-60.	France	150
16	Descottes B, Glineur D, Lachachi F, *et al.* Laparoscopic liver resection of benign liver tumors - Results of a multicenter European experience. *Surg Endosc* 2003;17:23-30.	Belgium	147
17	O'Rourke N, Fielding G. Laparoscopic right hepatectomy: Surgical technique. *J Gastrointest Surg* 2004;8:213-6.	Australia	141
18	Katkhouda N, Hurwitz M, Gugenheim J, *et al.* Laparoscopic management of benign solid and cystic lesions of the liver. *Ann Surg* 1999;229:460-6.	USA	130
19	Belli G, Fantini C, D'Agostino A, *et al.* Laparoscopic versus open liver resection for hepatocellular carcinoma in patients with histologically proven cirrhosis: short- and middle-term results. *Surg Endosc* 2007;21:2004-11.	Italy	129
20	Dagher I, Proske JM, Carloni A, *et al.* Laparoscopic liver resection: results for 70 patients. *Surg Endosc* 2007;21:619-24.	France	126

Table 1 *(continued)*

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N	Article (authors. title. journal)	Country	Citations
21	Fong Y, Jarnagin W, Conlon KC, *et al.* Hand-assisted laparoscopic liver resection: lessons from an initial experience. *Arch Surg* 2000;135:854-9.	USA	126
22	Chang S, Laurent A, Tayar C, *et al.* Laparoscopy as a routine approach for left lateral sectionectomy. *Br J Surg* 2007;94:58-63.	France	124
23	Cherqui D, Soubrane O, Husson E, *et al.* Laparoscopic living donor hepatectomy for liver transplantation in children. *Lancet* 2002;359:392-6.	France	124
24	Castaing D, Vibert E, Ricca L, *et al.* Oncologic results of laparoscopic versus open hepatectomy for colorectal liver metastases in two specialized centers. *Ann Surg* 2009;250:849-55.	France	123
25	Nguyen KT, Laurent A, Dagher I, *et al.* Minimally invasive liver resection for metastatic colorectal cancer: a multi-institutional, international report of safety, feasibility, and early outcomes. *Ann Surg* 2009;250:842-8.	USA	121
26	Mala T, Edwin B, Gladhaug I, *et al.* A comparative study of the short-term outcome following open and laparoscopic liver resection of colorectal metastases. *Surg Endosc* 2002;16:1059-63.	Norway	121
27	Rau HG, Buttler E, Meyer G, *et al.* Laparoscopic liver resection compared with conventional partial hepatectomy- a prospective analysis. *Hepatogastroenterology* 1998;45:2333-8.	Germany	121
28	Shimada M, Hashizume M, Maehara S, *et al.* Laparoscopic hepatectomy for hepatocellular carcinoma. *Surg Endosc* 2001;15:541-4.	Japan	110
29	Viganò L, Laurent A, Tayar C, *et al.* The learning curve in laparoscopic liver resection: improved feasibility and reproducibility. *Ann Surg* 2009;250:772-82.	France	108
30	Gayet B, Cavaliere D, Vibert E, *et al.* Totally laparoscopic right hepatectomy. *Am J Surg* 2007;194:685-9.	France	107
31	Descottes B, Lachachi F, Sodji M, *et al.* Early experience with laparoscopic approach for solid liver tumors: initial 16 cases. *Ann Surg* 2000;232:641-5.	France	103
32	Bryant R, Laurent A, Tayar C, *et al.* Laparoscopic liver resection-understanding its role in current practice: the Henri Mondor Hospital experience. *Ann Surg* 2009;250:103-11.	France	102
33	Cho JY, Han HS, Yoon YS, *et al.* Feasibility of laparoscopic liver resection for tumors located in the posterosuperior segments of the liver, with a special reference to overcoming current limitations on tumor location. *Surgery* 2008;144:32-8.	Korea	101
34	Tranchart H, Di Giuro G, Lainas P, *et al.* Laparoscopic resection for hepatocellular carcinoma: a matched-pair comparative study. *Surg Endosc* 2010;24:1170-6.	France	98
35	Sasaki A, Nitta H, Otsuka K, *et al.* Ten-year experience of totally laparoscopic liver resection in a single institution. *Br J Surg* 2009;96:274-9.	Japan	94
36	Dagher I, Di Giuro G, Dubrez J, *et al.* Laparoscopic versus open right hepatectomy: a comparative study. *Am J Surg* 2009;198:173-7.	France	93
37	Topal B, Fieuws S, Aerts R, *et al.* Laparoscopic versus open liver resection of hepatic neoplasms: comparative analysis of short-term results. *Surg Endosc* 2008;22:2208-13.	Belgium	92
38	Gagner M, Rogula T, Selzer D. Laparoscopic liver resection: benefits and controversies. *Surg Clin North Am* 2004;84:451-62.	USA	89
39	Chen HY, Juan CC, Ker CG. Laparoscopic liver surgery for patients with hepatocellular carcinoma. *Ann Surg Oncol* 2008;15:800-6.	Taiwan	88
40	Koffron A, Geller D, Gamblin TC, *et al.* Laparoscopic liver surgery: Shifting the management of liver tumors. *Hepatology* 2006;44:1694-700.	USA	87

Table 1 *(continued)*

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N	Article (authors. title. journal)	Country	Citations
41	Soubrane O, Cherqui D, Scatton O, *et al.* Laparoscopic left lateral sectionectomy in living donors: safety and reproducibility of the technique in a single center. *Ann Surg* 2006;244:815-20.	France	85
42	Polignano FM, Quyn AJ, de Figueiredo RS, *et al.* Laparoscopic versus open liver segmentectomy: prospective, case-matched, intention-to-treat analysis of clinical outcomes and cost effectiveness. *Surg Endosc* 2008;22:2564-70.	UK	84
43	Ishizawa T, Gumbs AA, Kokudo N, *et al.* Laparoscopic segmentectomy of the liver: from segment I to VIII. *Ann Surg* 2012;256:959-64.	France	83
44	Yagci G, Ustunsoz B, Kaymakcioglu N, *et al.* Results of surgical, laparoscopic, and percutaneous treatment for hydatid disease of the liver: 10 years experience with 355 patients. *World J Surg* 2005;29:1670-9.	Turkey	82
45	Takagi S. Hepatic and portal vein blood flow during carbon dioxide pneumoperitoneum for laparoscopic hepatectomy. *Surg Endosc* 1998;12:427-31.	Japan	82
46	Wakabayashi G, Cherqui D, Geller DA, *et al.* Recommendations for laparoscopic liver resection: a report from the second international consensus conference held in Morioka. *Ann Surg* 2015;261:619-29.	Japan	81
47	Cherqui D. Laparoscopic liver resection. *Br J Surg* 2003;90:644-6.	France	80
48	Viganò L, Tayar C, Laurent A, *et al.* Laparoscopic liver resection: a systematic review. *J Hepatobiliary Pancreat Surg* 2009;16:410-21.	France	78
49	Dagher I, Belli G, Fantini C, *et al.* Laparoscopic hepatectomy for hepatocellular carcinoma: a European experience. *J Am Coll Surg* 2010;211:16-23.	France	74
50	Cai XJ, Yang J, Yu H, *et al.* Clinical study of laparoscopic versus open hepatectomy for malignant liver tumors. *Surg Endosc* 2008;22:2350-6.	China	70
51	Dulucq JL, Wintringer P, Stabilini C, *et al.* Laparoscopic liver resections: a single center experience. *Surg Endosc* 2005;19:886-91.	France	70
52	Lin NC, Nitta H, Wakabayashi G. Laparoscopic major hepatectomy: a systematic literature review and comparison of 3 techniques. *Ann Surg* 2013;257:205-13.	Japan	67
53	Samama G, Chiche L, Bréfort JL, *et al.* Laparoscopic anatomical hepatic resection. Report of four left lobectomies for solid tumors. *Surg Endosc* 1998;12:76-8.	France	67
54	Nitta H, Sasaki A, Fujita T, *et al.* Laparoscopy-assisted major liver resections employing a hanging technique: the original procedure. *Ann Surg* 2010;251:450-3.	Japan	65
55	Feuerstein M, Mussack T, Heining SM, *et al.* Intraoperative laparoscope augmentation for port placement and resection planning in minimally invasive liver resection. *IEEE Trans Med Imaging* 2008;27:355-69.	Japan	64
56	Gigot JF, Legrand M, Hubens G, *et al.* Laparoscopic treatment of nonparasitic liver cysts: adequate selection of patients and surgical technique. *World J Surg* 1996;20:556-61.	Belgium	64
57	Burpee SE, Kurian M, Murakame Y, *et al.* The metabolic and immune response to laparoscopic versus open liver resection. *Surg Endosc* 2002;16:899-904.	USA	62
58	Vanounou T, Steel JL, Nguyen KT, *et al.* Comparing the clinical and economic impact of laparoscopic versus open liver resection. *Ann Surg Oncol* 2010;17:998-1009.	Canada	61
59	Cho JY, Han HS, Yoon YS, *et al.* Experiences of laparoscopic liver resection including lesions in the posterosuperior segments of the liver. *Surg Endosc* 2008;22:2344-9.	Korea	61

Table 1 *(continued)*

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N	Article (authors. title. journal)	Country	Citations
60	Abdel-Atty MY, Farges O, Jagot P *et al.* Laparoscopy extends the indications for liver resection in patients with cirrhosis. *Br J Surg* 1999;86:1397-400.	France	60
61	Lai EC, Tang CN, Ha JP, *et al.* Laparoscopic liver resection for hepatocellular carcinoma: ten-year experience in a single center. *Arch Surg* 2009;144:143-7; discussion 148.	China	59
62	Ito K, Ito H, Are C, *et al.* Laparoscopic versus open liver resection: a matched-pair case control study. *J Gastrointest Surg* 2009;13:2276-83.	USA	58
63	Tsinberg M, Tellioglu G, Simpfendorfer CH, *et al.* Comparison of laparoscopic versus open liver tumor resection: a case-controlled study. *Surg Endosc* 2009;23:847-53.	USA	58
64	Mala T, Edwin B, Rosseland AR, *et al.* Laparoscopic liver resection: experience of 53 procedures at a single center. *J Hepatobiliary Pancreat Surg* 2005;12:298-303.	Norway	58
65	Dagher I, Lainas P, Carloni A, *et al.* Laparoscopic liver resection for hepatocellular carcinoma. *Surg Endosc* 2008;22:372-8.	France	57
66	Baker TB, Jay CL, Ladner DP, *et al.* Laparoscopy-assisted and open living donor right hepatectomy: a comparative study of outcomes. *Surgery* 2009;146:817-23; discussion 823-5.	USA	55
67	Yoon YS, Han HS, Cho JY, *et al.* Total laparoscopic liver resection for hepatocellular carcinoma located in all segments of the liver. *Surg Endosc* 2010;24:1630-7.	Korea	54
68	Laurent A, Tayar C, Andréoletti M, *et al.* Laparoscopic liver resection facilitates salvage liver transplantation for hepatocellular carcinoma. *J Hepatobiliary Pancreat Surg* 2009;16:310-4.	France	54
69	Buell JF, Koffron AJ, Thomas MJ, *et al.* Laparoscopic liver resection. *J Am Coll Surg* 2005;200:472-80.	USA	54
70	Khoury G, Abiad F, Geagea T, *et al.* Laparoscopic treatment of hydatid cysts of the liver and spleen. *Surg Endosc* 2000;14:243-5.	Lebanon	53
71	Diez J, Decoud J, Gutierrez L, *et al.* Laparoscopic treatment of symptomatic cysts of the liver. *Br J Surg* 1998;85:25-7.	Argentina	53
72	Abu Hilal M, Underwood T, Zuccaro M, *et al.* Short- and medium-term results of totally laparoscopic resection for colorectal liver metastases. *Br J Surg* 2010;97:927-33.	UK	51
73	Berber E, Akyildiz HY, Aucejo F, *et al.* Robotic versus laparoscopic resection of liver tumours. *HPB (Oxford)* 2010;12:583-6.	USA	50
74	Manterola C, Fernández O, Muñoz S, *et al.* Laparoscopic pericystectomy for liver hydatid cysts. *Surg Endosc* 2002;16:521-4.	Chile	50
75	Patriti A, Ceccarelli G, Bartoli A, *et al.* Laparoscopic and robot-assisted one-stage resection of colorectal cancer with synchronous liver metastases: a pilot study. *J Hepatobiliary Pancreat Surg* 2009;16:450-7.	Italy	49
76	Cho JY, Han HS, Yoon YS, *et al.* Outcomes of laparoscopic liver resection for lesions located in the right side of the liver. *Arch Surg* 2009;144:25-9.	Korea	49
77	Sağlam A. Laparoscopic treatment of liver hydatid cysts. *Surg Laparosc Endosc* 1996;6:16-21.	Turkey	49
78	Aldrighetti L, Guzzetti E, Pulitanò C, *et al.* Case-matched analysis of totally laparoscopic versus open liver resection for HCC: short and middle term results. *J Surg Oncol* 2010;102:82-6.	Italy	46
79	Koffron AJ, Kung RD, Auffenberg GB, *et al.* Laparoscopic liver surgery for everyone: the hybrid method. *Surgery* 2007;142:463-8; discussion 468.e1-2.	USA	46
80	Kazaryan AM, Marangos IP, Røsok BI, *et al.* Laparoscopic resection of colorectal liver metastases: surgical and long-term oncologic outcome. *Ann Surg* 2010;252:1005-12.	Norway	45

Table 1 *(continued)*

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N	Article (authors. title. journal)	Country	Citations
81	Troisi R, Montalti R, Smeets P, *et al.* The value of laparoscopic liver surgery for solid benign hepatic tumors. *Surg Endosc* 2008;22:38-44.	Belgium	45
82	Fiamingo P, Tedeschi U, Veroux M, *et al.* Laparoscopic treatment of simple hepatic cysts and polycystic liver disease. *Surg Endosc* 2003;17:623-6.	Italy	45
83	Kazaryan AM, Pavlik Marangos I, Rosseland AR, *et al.* Laparoscopic liver resection for malignant and benign lesions: ten-year Norwegian single-center experience. *Arch Surg* 2010;145:34-40.	Norway	44
84	Zhou YM, Shao WY, Zhao YF, *et al.* Meta-analysis of laparoscopic versus open resection for hepatocellular carcinoma. *Dig Dis Sci* 2011;56:1937-43.	China	42
85	Ardito F, Tayar C, Laurent A, *et al.* Laparoscopic liver resection for benign disease. *Arch Surg* 2007;142:1188-93; discussion 1193.	France	41
86	Bickel A, Daud G, Urbach D, *et al.* Laparoscopic approach to hydatid liver cysts. Is it logical? Physical, experimental, and practical aspects. *Surg Endosc* 1998;12:1073-7.	Israel	41
87	Khoury G, Jabbour-Khoury S, Bikhazi K. Results of laparoscopic treatment of hydatid cysts of the liver. *Surg Endosc* 1996;10:57-9.	Lebanon	41
88	Truant S, Bouras AF, Hebbar M, *et al.* Laparoscopic resection *vs.* open liver resection for peripheral hepatocellular carcinoma in patients with chronic liver disease: a case-matched study. *Surg Endosc* 2011;25:3668-77.	France	39
89	Hüscher CG, Lirici MM, Chiodini S, *et al.* Current position of advanced laparoscopic surgery of the liver. *J R Coll Surg Edinb* 1997;42:219-25.	Italy	39
90	Gugenheim J, Mazza D, Katkhouda N, *et al.* Laparoscopic resection of solid liver tumours. *Br J Surg* 1996;83:334-5.	France	39
91	Xiong JJ, Altaf K, Javed MA, *et al.* Meta-analysis of laparoscopic vs open liver resection for hepatocellular carcinoma. *World J Gastroenterol* 2012;18:6657-68.	China	38
92	Abu Hilal M, Di Fabio F, Abu Salameh M, *et al.* Oncological efficiency analysis of laparoscopic liver resection for primary and metastatic cancer: a single-center UK experience. *Arch Surg* 2012;147:42-8.	UK	38
93	Reddy SK, Tsung A, Geller DA. Laparoscopic liver resection. *World J Surg* 2011;35:1478-86.	USA	38
94	Stoot JH, van Dam RM, Busch OR, *et al.* The effect of a multimodal fast-track programme on outcomes in laparoscopic liver surgery: a multicentre pilot study. *HPB (Oxford)* 2009;11:140-4.	Netherlands	38
95	Han HS, Cho JY, Yoon YS. Techniques for performing laparoscopic liver resection in various hepatic locations. *J Hepatobiliary Pancreat Surg* 2009;16:427-32.	Korea	36
96	Belli G, Fantini C, D'Agostino A, *et al.* Laparoscopic left lateral hepatic lobectomy: a safer and faster technique. *J Hepatobiliary Pancreat Surg* 2006;13:149-54.	Italy	36
97	Tzanis D, Shivathirthan N, Laurent A, *et al.* European experience of laparoscopic major hepatectomy. *J Hepatobiliary Pancreat Sci* 2013;20:120-4.	France	35
98	Cannon RM, Brock GN, Marvin MR, *et al.* Laparoscopic liver resection: an examination of our first 300 patients. *J Am Coll Surg* 2011;213:501-7.	USA	35
99	Robles R, Marín C, Abellán B, *et al.* A new approach to hand-assisted laparoscopic liver surgery. *Surg Endosc* 2008;22:2357-64.	Spain	34
100	Abu Hilal M, Pearce NW. Laparoscopic left lateral liver sectionectomy: a safe, efficient, reproducible technique. *Dig Surg* 2008;25:305-8.	UK	34

Table 2 Journals in which the top-100 cited articles were published

Rank	*Journal*	Number of articles
1	*Surgical Endoscopy*	27
2	*Annals of Surgery*	20
3	*British Journal of Surgery*	8
4	*Archives of Surgery*	7
4	*Journal of Hepato-Biliary-Pancreatic Sciences*	7
6	*Journal of the American College of Surgeons*	4
6	*Surgery*	4
8	*American Journal of Surgery*	3
8	*World Journal of Surgery*	3
10	*Annals of Surgical Oncology*	2
10	*HPB*	2
12	*Journal of Gastrointestinal Surgery*	2
12	*Digestive Diseases and Sciences*	1
12	*Digestive Surgery*	1
12	*Hepato-Gastroenterology*	1
12	*Hepatology*	1
12	*IEEE Transactions on Medical Imaging*	1
12	*Journal of Surgical Oncology*	1
12	*Journal of the Royal College of Surgeons of Edinburgh*	1
12	*Lancet*	1
12	*Surgical Clinics of North America*	1
12	*Surgical Laparoscopy & Endoscopy*	1
12	*World Journal of Gastroenterology*	1

LLR is spreading around the world.

According to the International Position on LLR, many centers have shown a steady increase in the number of resections each year and publications seem to have followed as a consequence. In the same paper, a consensus of experts proposed the best indications for LLR: a solitary lesion less than 5 cm in diameter and nodules located in the anterior segments (2,4). Technical recommendations included that LLR should be applied far from the hepatic hilum, and the vena cava. Concerning the oncological proficiency with LLR, this should only be adopted if adequate margins can be obtained laparoscopically, keeping a safety distance of the nodule from the line of transection. Six years after the Louisville statement, the Second International Consensus Conference on LLR was held in Morioka, Japan, in 2014 to evaluate the current status of laparoscopic liver surgery and to provide strong recommendations to aid its future development (4). These two consensus conferences have outlined that the indications for LLR are continually expanding. The laparoscopic left lateral sectionectomy is defined as a gold standard procedure (5). Moreover, laparoscopic major hepatectomies are more often proposed as an evolution in the standard of care (6). Even malignancies such as colorectal metastases (7) or HCC (8,9) have been included as standard of care in selected cases. HCC as an indication for LLR is probably the most interesting one and with the greatest potentiality (10). This could explain why seventeen of the top 100 articles on LLR

Table 3 Only first or last authors with more than two papers has been reported, when a paper was multicentric the corresponding authors was considered as the country paper

Country/author	Number of articles
Country	
France	30
USA	18
Japan	9
Italy	7
Belgium	6
Korea	5
China	4
Norway	4
UK	4
Lebanon	2
Turkey	2
Argentina	1
Australia	1
Canada	1
Chile	1
Germany	1
Israel	1
Netherlands	1
Spain	1
Taiwan	1
First author	
Dagher I	5
Cherqui D	4
Abu Hilal M	3
Buell JF	3
Cho JY	3
Koffron AJ	3
Belli G	2
Descottes B	2
Gigot JF	2
Kaneko H	2
Kazaryan AM	2
Khoury G	2
Laurent A	2
Mala T	2
Nguyen KT	2
Viganò L	2
Last author	
Cherqui D	7
Abecassis M	4
Fagniez PL	4
Franco D	3
Gayet B	3
Pearce N	3
Shin SH	3
Wakabayashi G	3
Buell J	2
Dagher I	2
David A	2
Edwin B	2
Gamblin TC	2
Mathisen O	2
Shiba T	2

are focused on resections for HCC. LLR for HCC has been shown to improve postoperative morbidity even in patients with Child B cirrhosis (11). Nevertheless, in case of salvage liver transplantation after a laparoscopic resection for HCC, outcomes are comparable to patients who had open surgery including operative time, oncologic radicality, morbidity and mortality, but with the added advantages of laparoscopic surgery such as earlier return to mobility, lower blood losses and less pain (12,13).

Laparoscopic living donor hepatectomy for liver transplantation may encourage both donors and recipients to opt for this type of practice thanks to the reduced invasiveness and higher appeal associated with LLR. However, this procedure is a recognized technical challenge for the surgeon who is probably why we could find only three articles within the top 100 articles on LLR.

Future considerations

Minimally invasive approaches are expected to continue to gain space in liver surgery in the near future. One of the next goals for LLR will be to standardize the practice of resections for HCC in patients with cirrhosis. Surgery for living liver donation remains an extremely challenging

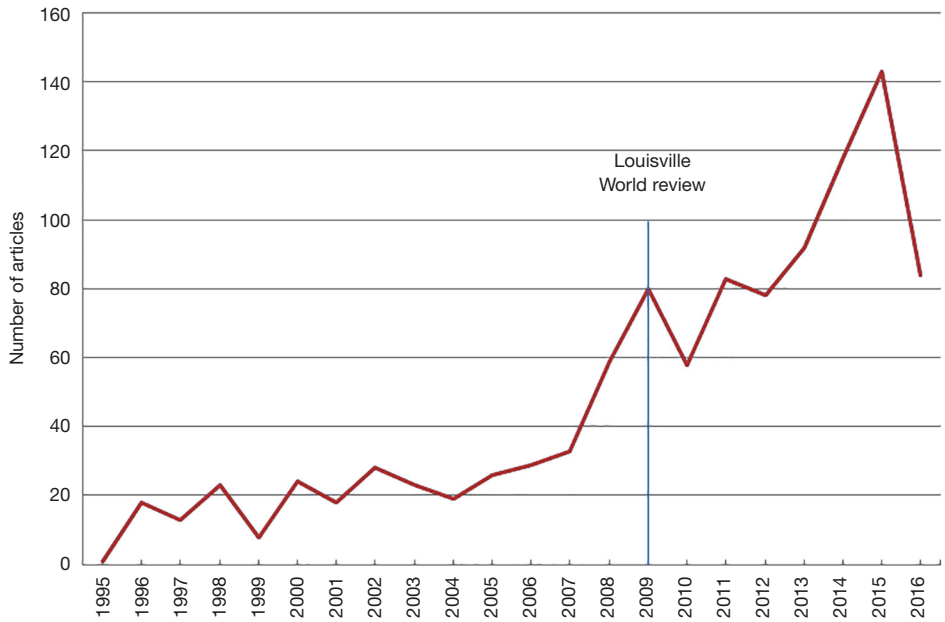

Figure 2 Cumulative numbers of articles over time on laparoscopic liver surgery.

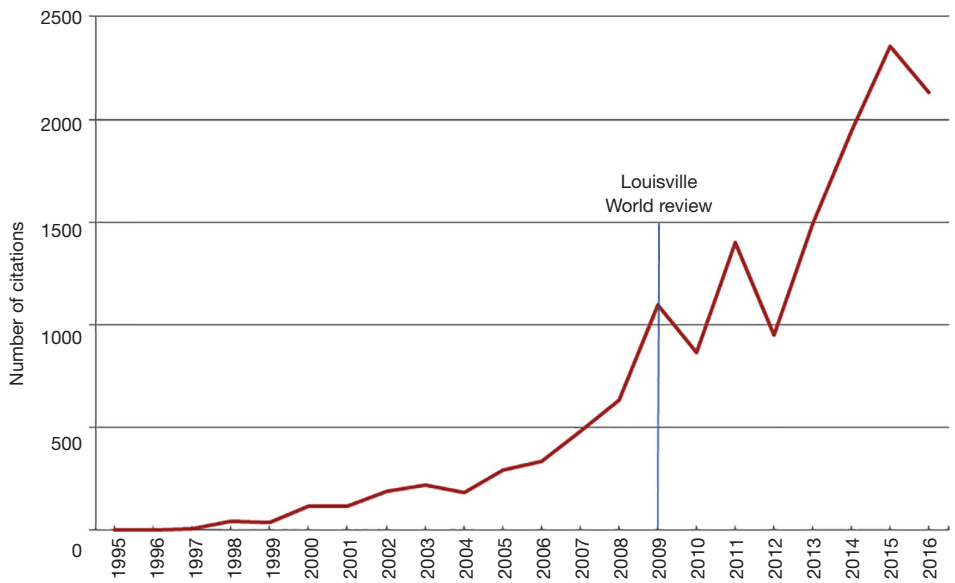

Figure 3 Cumulative numbers of citations over time on laparoscopic liver surgery articles.

field for pure laparoscopic surgery and the aid of robotic assistance could help popularize the adoption of minimally invasive approaches (14).

Conclusions

Having analyzed the 100 top articles on LLR, two main points are to be emphasized: LLR is now performed worldwide and surgical indications are continuing to expand. Furthermore, published articles on LLR are growing proportionally to its widespread. Randomized and prospective studies will be needed to build evidence around this topic and to strengthen the recommendations which to date are mainly based on promising clinical series only.

Acknowledgments

Funding: None.

Footnote

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/ls.2017.12.01). GBLS serves as the Editor-in-Chief of *Laparoscopic Surgery*. The other author has no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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doi: 10.21037/ls.2017.12.01
Cite this article as: Levi Sandri GB, Spoletini G. The one hundred most-cited articles on laparoscopic liver surgery. Laparosc Surg 2017;1:3.