Norman M. Rich, MD, Section Editor

One hundred vascular surgery citation "classics" from the surgical literature

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From the early twentieth century to the present day, the field of vascular surgery has evolved from a fledgling specialty to one of the most technologically advanced surgical specialties in the modern era. Pioneering discoveries in disease pathophysiology and innovative techniques have laid the foundation for the vascular surgeon's role in managing vascular disease.

The foundation for modern vascular surgery is reflected by the pioneering work conducted around the early twentieth century. Beginning with John Murphy's first report of a successful arterial end-to-end anastomosis in 1897, the practice of repairing instead of ligating damaged blood vessels changed medical practice forever.[1] Alexis Carrel experimented with an anastomotic technique to suture vein grafts to arteries in 1906, subsequently allowing Jean Kunlin to perform the first lower extremity bypass with saphenous vein in 1948 in Paris, France.[1]

The surgical approach to abdominal aortic aneurysms initially included the techniques of ligation or external wrapping devices with suboptimal results.[1] Charles Dubost changed this approach to one of using an interposed graft to exclude blood flow to the aneurysm when he performed the first abdominal aortic aneurysm repair with a graft in 1952.[2] Not for another 38 years would his technique face opposition, as Juan Parodi performed the world's first endovascular aortic aneurysm repair in 1990.[3]

One may argue the endovascular era in vascular surgery started as early as 1924 when Barney Brooks performed the first lower extremity angiogram using sodium iodide injections.[1] Unintentionally, Charles Dotter developed percutaneous angioplasty when he accidentally traversed an arterial occlusion of the superficial femoral artery in 1964.[1]

Building upon the previous work of carotid reconstruction for cerebrovascular disease, Michael Debakey developed the endarterectomy of the carotid artery to prevent stroke in 1953.[1] He published his own short- and intermediate-term results in the Annals of Surgery in 1965, helping establish carotid endarterectomy as a beneficial procedure for the prevention of stroke.[4] In 1991 and 1995, the North American Symptomatic Carotid Endarterectomy Trial in the New England Journal of Medicine and Asymptomatic Carotid Atherosclerosis Study in the Journal of the American Medical Association, respectively, helped to finally answer our longstanding question: who really benefits from carotid endarterectomy.[5,6]

Much of the above historical progress and that of others is reflected by the proliferation of vascular surgery scientific articles published in the surgical literature (Fig 1). Several key papers published in the last century have had a substantial influence on the field. One means to determine the influence of an article is to measure its number of citations, or the acknowledgement one article receives from another.[7] More cited articles arguably have a greater impact on a field, since a citation often recognizes an article's contribution to new findings and research.[7,8]

Citation analysis has become a popular means to measure the impact an article has on the scientific community. Starting with Garfield's analysis of the 100 most cited articles in *Journal of the American Medical Association*, numerous medical specialties have used citation analysis to identify "classic" or highly influential articles in their specialty.[9-12] Given that vascular surgery has evolved into a distinct surgical field from general surgery over the last century, this study aims to identify the most cited articles in vascular surgery from general and vascular surgery journals published in the last century.

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Competition of interest: none.

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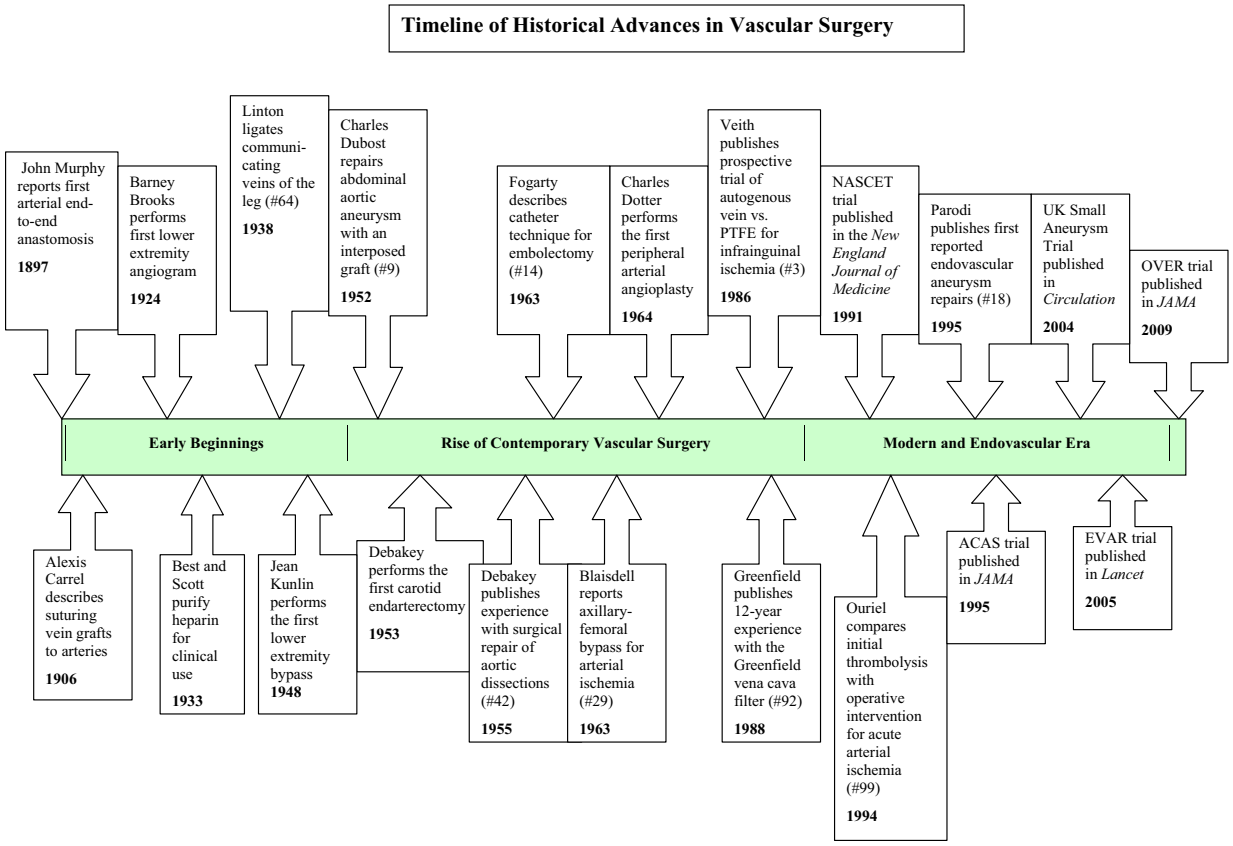

Fig 1. Timeline of important historical advances in vascular surgery. Articles listed in Table II are identified by their ranking.

MATERIALS AND METHODS

The Science Citation Index of the Institute for Scientific Information was queried from the years 1900 to 2000.[13] The Science Citation Index is an electronic search engine cataloging over 6400 articles related to science and technology. The database can be used to determine which later articles have cited a particular earlier article.[13] Articles pertaining to vascular surgery published in general and vascular surgery journals were ranked according to the number of times they were cited in the medical literature. Topics pertaining to arteries, veins, major lymphatics not involving cancer, hemodialysis access, and vascular basic science were considered. Articles involving solely the heart and the intracranial circulation were not considered. Reporting standards and review articles were excluded as well. The journals searched are shown in Table I. The 100 most frequently cited articles were then selected for further analysis. Journal name, first author name, study design, primary subject matter of the article, and aim of the study were recorded on a computerized spreadsheet using Microsoft Excel (Microsoft Corp, Redmond, Wash) and analyzed using descriptive statistics using SPSS 12.01 (SPSS Inc, Chicago, Ill).

RESULTS

The 100 most cited articles in vascular surgery are depicted in Table II, ranked in descending order based upon the number of citations the article has received. The number of citations ranged from 750 to 194 per article (mean, 280 ± 107). The year of publication ranged from 1938 to 2000, with 71% published after 1970. The number of articles published in each decade is depicted in Fig 2. All of the papers were published in one of the following seven surgical journals: *Annals of Surgery, British Journal of Surgery, Archives of Surgery, Surgery, Journal of the American College of Surgeons* (formerly *Surgery, Gynecology, and Obstetrics*), *American Journal of Surgery,* and *Journal of Vascular Surgery* (Table III).

The primary subject matter of the articles includes arterial occlusive disease (n = 27), arterial aneurysms (n = 23), arterial hemodynamics (n = 15), vascular trauma (n = 3), venous disease (n = 13), carotid disease (n = 11), renal occlusive (n = 2), hemodialysis access (n = 2), lymphatic (n = 1), antibiotic prophylaxis (n = 1), vascular tumors (n = 1), and diabetic foot ulcers (n = 1; Fig 3). The study designs included prospective randomized clinical trials (n = 8), prospective cohort studies (n = 9),

Table I. List of queried journals

American Journal of Surgery
American Surgeon
Annals of Surgery
Annals of Thoracic Surgery
Annals of Vascular Surgery
Archives of Surgery
British Journal of Surgery
Current Problems in Surgery
European Journal of Cardiothoracic Surgery
European Journal of Surgical Research
European Journal of Vascular and Endovascular Surgery
European Journal of Vascular Surgery
Journal of Cardiac Surgery
Journal of Cardiothoracic Surgery
Journal of Cardiovascular Surgery
Journal of Endovascular Therapy
Journal of Surgical Research
Journal of the American College of Surgeons
Journal of Vascular Access
Journal of Vascular Research
Journal of Vascular Surgery
Seminars in Vascular Surgery
Surgery
Surgery Clinics of North America
Surgery, Gynecology, and Obstetrics
The Surgeon
Thoracic and Cardiovascular Surgery
Vascular
Vascular and Endovascular Surgery
World Journal of Surgery

retrospective reviews (n = 46), and case series or basic science reports (n = 37). The primary purpose of the studies included description of clinical outcomes (n = 49), description of a disease process (n = 30), depiction or evaluation of a diagnostic modality (n = 10), and description of a technique (n = 11).

DISCUSSION

In this study, we have identified the 100 most cited articles pertaining to vascular surgery published in surgical journals during the twentieth century. Articles receiving a large number of citations from the medical literature are generally regarded as high impact or "classic" contributions. The list of articles in Table II outlines many studies that have had a seminal impact on the field of vascular surgery, and it also illustrates the historical evolution of vascular surgery. Notable examples of this evolution include Dubost's early technique for abdominal aortic aneurysm repair with a graft in 1952, to the later development of Parodi's endovascular aortic aneurysm repair in 1995, which have both forever changed the surgical repair of abdominal aortic aneurysms.

Analysis of the most cited articles reveals that most of the highly cited articles in vascular surgery involve arterial disease, particularly aortic aneurysms, peripheral obstructive disease, and carotid disease. These conditions can cause significant morbidity and mortality, and surgical management is a main source of treatment for these conditions. The primary objective of the articles is noteworthy, since almost half (49 out of 100) of the articles describe clinical outcomes. This suggests that research interests in vascular disease heavily emphasize the results of techniques and their contribution to the reduction of morbidity and mortality. Several historic papers on this list have served as the foundation for calculating survival benefit, determining complications, and selecting patients who may benefit from a surgical intervention.

Although many of the most important contributions to vascular surgery are depicted in this list, there are several articles describing methods that are no longer considered in daily practice, such as detecting venous thrombosis using 125-I-labeled fibrinogen by Flanc in 1968.

Several limitations exist with using citation counts to identify the most influential articles in a discipline. Newer articles, arguably, have less time to attain citations than older articles. Previous bibliometric studies have suggested a period of at least 5 years after publication before using citation status as a measure of impact.[7,8] This was our reasoning behind limiting our search to articles published during the last century. Interestingly, most articles in this study were published after 1970. This can partially be explained by the tendency of well-known knowledge to no longer receive citation, since it already represents generally accepted information. Citation counts are also affected by the inherent design of the Science Citation Index, which does not include textbook citations and citations from journals written in languages other than English.

Further limitations of this study include restriction of our search to only surgical journals. Several major vascular surgery advances have been published in general medical journals, such as the *New England Journal of Medicine* with the North American Symptomatic Carotid Endarterectomy Trial trial in 1991 receiving a total of 2966 citations and the original depiction of the autogenous arteriovenous fistula for hemodialysis access by Drs Brescia and Cimino in 1966 receiving 966 citations.[5,14] Our reasoning for not including these journals in our search stemmed from the difficulty on how to uniformly define what is and is not a vascular surgery article in these journals without encountering a large degree of selection bias. A large number of vascular biology basic science studies, drug treatment trials for vascular disease processes, and perioperative vascular surgery morbidity studies conducted by specialists other than vascular surgeons were encountered. Inclusion of these and similar vascular-related articles would have prevented a more in-depth look at some of the most influential articles published in the surgical literature.

In addition, although we attempted to search the most influential surgical journals in the literature, we may not have detected some highly cited articles from surgical journals we did not search. This list, therefore,

Table II. The 100 most cited articles in vascular surgery ranked in descending order based upon the number of citations the article has received.

Rank	*No. of citations*	*Article*
1	750	Rabinov K. Roentgen diagnosis of venous thrombosis in leg. Arch Surg 1972;104:134-44.
2	621	Debakey ME. Battle injuries of the arteries in World War II—an analysis of 2,471 cases. Ann Surg 1946;123:534-79.
3	610	Veith FJ. Six-year prospective multicenter randomized comparison of autologous saphenous-vein and expanded polytetrafluoroethylene grafts in infrainguinal arterial reconstructions. J Vasc Surg 1986;3:104-14.
4	538	Flanc C. Detection of venous thrombosis of legs using 125-I-labelled fibrinogen. Br J Surg 1968;55:742-7.
5	535	Sevitt S. Venous thrombosis and pulmonary embolism—a clinicopathological study in injured and burned patients. Br J Surg 1961;48:475-89.
6	489	Svensson LG. Experience with 1509 patients undergoing thoracoabdominal aortic operations. J Vasc Surg 1993;17: 357-70.
7	473	Szilagyi DE. Biologic fate of autogenous vein implants as arterial substitutes—clinical, angiographic and histopathologic observations in femoropopliteal operations for atherosclerosis. Ann Surg 1976;178:232-46.
8	472	Szilagyi DE. Infection in arterial reconstruction with synthetic grafts. Ann Surg 1972;176:321-33.
9	471	Dubost C. Resection of an aneurysm of the abdominal aorta—reestablishment of the continuity by a preserved human arterial graft, with result after 5 months. Arch Surg 1952;64:405-8.
10	445	Crawford ES. Thoracoabdominal aortic aneurysms—preoperative and intraoperative factors determining immediate and long-term results of operations in 605 patients. J Vasc Surg 1986;3:389-404.
11	403	Szilagyi DE. Contribution of abdominal aortic aneurysmectomy to prolongation of life. Ann Surg 1966;164:678-99.
12	398	Kakkar VV. Deep vein thrombosis of leg—is there a high risk group. Am J Surg 1970;120:527-30.
13	394	Zarins CK. AneuRx stent graft versus open surgical repair of abdominal aortic aneursyms: multicenter prospective clinical trial. J Vasc Surg 1999;29:292-306.
14	393	Fogarty TJ. A method for extraction of arterial emboli and thrombi. Surg Gynecol Obst 1963;116:241-4.
15	385	Negus D. 125-Labelled fibrinogen in diagnosis of deep-vein thrombosis and its correlation with phlebography. Brit J Surg 1968;55:835-9.
16	381	Debakey ME. Dissection and dissecting aneurysms of the aorta—20-year follow-up of 527 patients treated surgically. Surgery 1982;92:1118-34.
17	371	Palder SB. Vascular access for hemodialysis—patency rates and results of revision. Ann Surg 1985;202:235-9.
18	371	Parodi JC. Endovascular repair of abdominal aortic-aneurysms and other arterial lesions. J Vasc Surg 1995;21: 549-57.
19	355	Kakkar V. Diagnosis of deep vein thrombosis using I-125 fibrinogen test. Arch Surg 1972;104:152-9.
20	341	Yao ST. Ankle systolic pressure measurements in arterial disease affecting lower extremities. Brit J Surg 1969;56: 676-9.
21	334	Grace PA. Ischemia—reperfusion injury. Brit J Surg 1994;81:637-47.
22	334	Johnston KW. Five-year results of a prospective-study of percutaneous transluminal angioplasty. Ann Surg 1987;206: 403-13.
23	332	Zarins CK. Shear-stress regulation of artery lumen diameter in experimental atherogenesis. J Vasc Surg 1987;5: 413-20.
24	330	Herring M. Single-staged technique for seeding vascular grafts with autogenous endothelium. Surgery 1978;84: 498-504.
25	314	Thompson JE. Carotid endarterectomy for cerebrovascular insufficiency—long-term results in 592 patients followed up to 13 years. Ann Surg 1970;172:663-79.
26	310	Goldston J. Infection in vascular prostheses—clinical manifestations and surgical management. Am J Surg 1974;128: 225-33.
27	308	Berger K. Healing of arterial prosthesis in man—its incompleteness. Ann Surg 1972;175:118-27.
28	294	Gibbs NM. Venous thrombosis of the lower limbs with particular reference to bed-rest. Brit J Surg 1957;45:209-36.
29	291	Blaisdell FW. Axillary-femoral artery bypass for lower extremity ischemia. Surgery 1963;54:563-8.
30	291	Imparato AM. Intimal and neointimal fibrous proliferation causing failure of arterial reconstructions. Surgery 1978; 84:498-504.
31	290	Harris PL. Incidence and risk factors of late rupture, conversion, and death after endovascular repair of infrarenal aortic aneurysms: the EUROSTAR experience. J Vasc Surg 2000;32:739-49.
32	288	Moore WS. Transfemoral endovascular repair of abdominal aortic aneurysm: results of the North American EVT phase 1 trial. J Vasc Surg 1996;23:543-53.
33	288	Whittemore AD. Secondary femoro-popliteal reconstruction. Ann Surg 1981;193:35-42.
34	279	Debakey ME. Aneurysm of abdominal aorta—analysis of results of graft replacement therapy 1 to 11 years after operation. Ann Surg 1964;160:622-39.
35	277	Bickerstaff LK. Thoracic aortic aneurysms—a population-based study. Surgery 1982;92:1103-8.
36	277	Taylor LM. Present status of reversed vein bypass grafting—5 year results of a modern series. J Vasc Surg 1990;11: 193-206.
37	271	Gross RE. Methods for preservation and transplantation of arterial grafts—observations on arterial grafts in dogs—report of transplantation of preserved arterial grafts in 9 human cases. Surg Gynecol Obstet 1949;88:689-701.
38	270	May AG. Hemodynamic effects of arterial stenosis. Surgery 1963;53:513-24.
39	266	Drapanas T. Civilian vascular injuries—a critical appraisal of 3 decades of management. Annal Surg 1970;172: 351-60.

Table II. Continued

Rank	*No. of citations*	*Article*
40	262	Johnston KW. Multicenter prospective study of nonruptured abdominal aortic aneurysm—2 variables predicting morbidity and mortality. J Vasc Surg 1989;9:437-47.
41	257	Dean RH. Renovascular hypertension—anatomic and renal function changes during drug therapy. Arch Surg 1981; 116:1408-15.
42	255	Debakey ME. Surgical considerations of dissecting aneurysm of the aorta. Ann Surg 1955;142:586-612.
43	250	Moneta GL. Correlation of North American Symptomatic Carotid Endarectomy Trial (NASCET) angiographic definition of 70-percent to 99-percent internal carotid artery stenosis with duplex scanning. J Vasc Surg 1993;17: 152-9.
44	250	Baffour R. Enhanced angiogenesis and growth of collaterals by in vivo administration of recombinant basic fibroblast growth factor in a rabbit model of acute lower limb ischemia—dose response effect of basic fibroblast growth factor. J Vasc Surg 1992;16:181-91.
45	249	Liekweg WG. Vascular prosthetic infections—collected experience and results of treatment. Surgery 1977;81: 335-42.
46	245	Perry MO. Management of arterial injuries. Ann Surg 1971;173:403-8.
47	243	Diehl JT. Complications of abdominal aortic reconstruction—an analysis of perioperative risk factors in 557 patients. Ann Surg 1983;197:49-56.
48	241	Szilagyi DE. Autogenous vein grafting in femoropopliteal atherosclerosis—limits of its effectiveness. Surgery 1979; 86:836-51.
49	239	Katz DJ. Operative mortality rates for intact and ruptured abdominal aortic aneurysms in Michigan—an 11-year statewide experience. J Vasc Surg 1994;19:804-17.
50	239	Steed DL. Clinical evaluation of recombinant human platelet derived growth factor for the treatment of lower extremity diabetic ulcers. J Vasc Surg 1995;21:71-81.
51	237	Weismann RE. Arterial embolism occurring during systemic heparin therapy. Arch Surg 1958;76:219-27.
52	235	Blaisdell FW. Management of acute lower-extremity arterial ischemia due to embolism and thrombosis. Surgery 1978;84:822-34.
53	232	Naylor AR. Randomized study of carotid angioplasty and stenting versus carotid endarterectomy: a stopped trial. J Vasc Surg 1998;28:326-34.
54	232	Sauvage LR. Interspecies healing of arterial prostheses—observations, 1960 to 1974. Arch Surg 1974;109:698-705.
55	230	Davies MG. Pathobiology of intimal hyperplasia. Brit J Surg 1994;81:1254-69.
56	225	Bassiouny HS. Anastomotic intimal hyperplasia—mechanical injury or flow induced. J Vasc Surg 1992;15:708-17.
57	224	Kaiser AB. Antibiotic prophylaxis in vascular surgery. Ann Surg 1978;188:283-9.
58	220	Brewster DC. Optimal methods of aortoiliac reconstruction. Surgery 1978;84:739-48.
59	220	Callam MJ. Epidemiology of varicose veins. Brit J Surg 1994;81:167-73.
60	220	Strandness DE Jr. Ultrasonic flow detection—a useful technique in evaluation of peripheral vascular disease. Am J Surg 1967;113:311-20.
61	220	Vanbemmelen PS. Quantitative segmental evaluation of venous valvular reflux with duplex ultrasound scanning. J Vasc Surg 1989;10:425-31.
62	219	Blackshear WM. Detection of carotid occlusive disease by ultrasonic imaging and pulsed Doppler spectrum analysis. Surgery 1979;86:698-706.
63	219	Foster JH. Ten years experience with surgical management of renovascular hypertension. Ann Surg 1973;177: 755-66.
64	219	Linton RR. The communicating veins of the lower leg and the operative technique for their ligation. Ann Surg 1938; 107:582-93.
65	215	Dobrin PB. Mechanical factors predisposing to intimal hyperplasia and medial thickening in autogenous vein grafts. Surgery 1989;105:393-400.
66	215	Crawford ES. Aortoiliac occlusive disease—factors influencing survival and function following reconstructive operation over a 25-year period. Surgery 1981;90:1055-67.
67	215	Szilagyi DE. Clinical fate of patient with asymptomatic abdominal aortic aneurysm and unfit for surgical treatment. Arch Surg 1972;104:600-6.
68	215	Stanley JC. Splanchnic artery aneurysms. Arch Surg 1970;101:689-97.
69	214	Lusby RJ. Carotid plaque hemorrhage—its role in production of cerebral ischemia. Arch Surg 1982;117:1479-88.
70	214	Thompson JE. Asymptomatic carotid bruit—long-term outcome of patients having endarterectomy compared with unoperated controls. Ann Surg 1978;188:308-16.
71	212	Walker DI. Inflammatory aneurysms of abdominal aorta. Brit J Surg 1972;59:609-14.
72	210	Dobrin PB. Elastolytic and collagenolytic studies of arteries—implications for the mechanical properties of aneurysms. Arch Surg 1984;119:405-9.
73	210	May AG. Critical arterial stenosis. Surgery 1963;54:250-9.
74	210	May J. Concurrent comparison of endoluminal versus open repair in the treatment of abdominal aortic aneurysms: analysis of 303 patients by life table method. J Vasc Surg 1998;27:213-20.
75	209	Reilly LM. Carotid plaque histology using real-time ultrasonography—clinical and therapeutic implications. Am J Surg 1983;146:188-93.
76	208	Mann FC. The effect on the blood flow of decreasing the lumen of a blood vessel. Surgery 1938;4:249-52.
77	205	DeWeese JA. Results of carotid endarterectomies for transient ischemic attacks—5 years later. Ann Surg 1973;178:258-64.

Table II. Continued

Rank	*No. of citations*	*Article*
78	204	Coon WW. Clinicopathologic correlation in thromboembolism. Surg Gynecol Obstet 1959;109:259-69.
79	203	Zempo N. Matrix metalloproteinases of vascular wall cells are increased in balloon-injured rat carotid artery injury. J Vasc Surg 1994;20:209-17.
80	203	Cambria RP. Vascular complications associated with spontaneous aortic dissection. J Vasc Surg 1988;7:199-209.
81	203	Johnston KW. Multicenter prospective study of nonruptured abdominal aortic aneurysms—population and operative management. J Vasc Surg 1988;7:69-81.
82	203	Morrell MT. Post-mortem incidence of pulmonary embolism in a hospital population. Brit J Surg 1968;55:347-52.
83	202	Kinmonth JB. Primary lymphoedema—clinical and lymphangiographic studies of 107 patients in which the lower limbs were affected. Brit J Surg 1957;45:1-10.
84	202	Kresowik TF. A prospective study of the incidence and natural history of femoral vascular complications after percutaneous transluminal angioplasty. J Vasc Surg 1991;13:328-35.
85	200	Cranley JJ. Diagnosis of deep venous thrombosis. Arch Surg 1976;111:34-6.
86	200	Debakey ME. Cerebral arterial insufficiency—1 to 11 year results following arterial reconstructive operation. Ann Surg 1965;161:921-45.
87	200	Graor RA. Results of a prospective randomized trial evaluating surgery versus thrombolysis for ischemia of the lower extremity—the STILE trial. Ann Surg 1994;220:251-68.
88	200	Stoney RJ. Recurrent carotid stenosis. Surgery 1976;80:705-10.
89	200	Linton RR. Autogenous saphenous vein bypass grafts in femoropopliteal obliterative arterial disease. Surgery 1962; 51:62-73.
90	200	Whittemore AD. Aortic aneurysm repair—reduced operative mortality associated with maintenance of optimal cardiac performance. Ann Surg 1980;192:414-21.
91	199	Bunt TJ. Synthetic vascular graft infections. Surgery 1983;93:733-46.
92	198	Greenfield LJ. Twelve-year clinical experience with the Greenfield vena cava filter. Surgery 1988;104:706-12.
93	196	Isner JM. Treatment of thromboangiitis obliterans (Buerger's disease) by intramuscular gene transfer of vascular endothelial growth factor: preliminary clinical results. J Vasc Surg 1998;28:964-73.
94	195	Christopoulos DG. Air-plethysmography and the effect of elastic compression on venous hemodynamics of the leg. J Vasc Surg 1987;5:148-59.
95	195	Kherlakian GM. Comparison of autogenous fistula versus expanded polytetrafluoroethylene graft fistula for angioaccess in hemodialysis. Am J Surg 1986;152:238-43.
96	195	Darling RC. Durability of femoropopliteal reconstructions—endarterectomy versus vein bypass grafts. Am J Surg 1972;123:472-9.
97	195	Shaw RS. Management of sepsis complicating arterial reconstructive surgery. Surgery 1963;53:75-86.
98	195	Zierler RE. Carotid artery stenosis following endarterectomy. Arch Surg 1982;117:1408-15.
99	194	Ouriel K. A comparison of thrombolytic therapy with operative revascularization in the initial treatment of acute peripheral arterial ischemia. J Vasc Surg 1994;19:1021-30.
100	194	Shamblin WR. Carotid body tumor (chemodectoma). Clinicopathologic analysis of 90 cases. Am J Surg 1971;122:732-9.

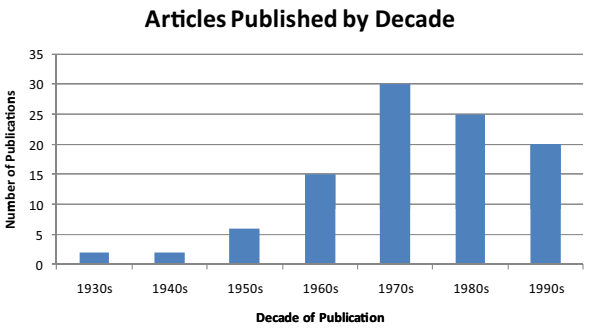

Fig 2. Number of highly cited articles published by decade.

Table III. Number of top cited articles by journal

Journal	*Number of articles*
Journal of Vascular Surgery	25
Annals of Surgery	22
Surgery	20
Archives of Surgery	12
British Journal of Surgery	11
American Journal of Surgery	7
Journal of the American College of Surgeons (formerly *Surgery, Gynecology, and Obstetrics*)	3

can only be used as a partial measure of the most influential articles in vascular surgery.

CONCLUSIONS

Vascular surgery has undergone tremendous growth and advancement during the past century. Articles in high impact general and vascular surgery journals reflect much of the contributions to the medical literature generated by vascular surgeons.

AUTHOR CONTRIBUTIONS

Conception and design: DO, JJ
Analysis and interpretation: DO, JJ, NG, EL, LS
Data collection: DO, JJ

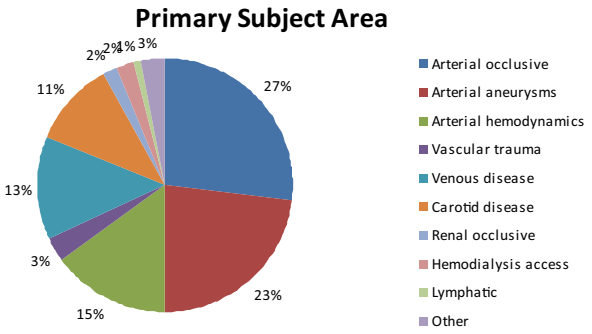

Fig 3. Primary subject matter of the highly cited articles by percentage.

Writing the article: DO
Critical revision of the article: DO, NG, EL, LS
Final approval of the article: DO, NG, LS
Statistical analysis: JJ
Obtained funding: EL
Overall responsibility: DO, NG

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