Journal of Coloproctology

www.jcol.org.br

Review Article

One hundred citation classics in benign anorectal disease: a bibliometric analysis of seven decades (1950–2019)

Khalid A. Hureibi[a], *Elgeilani M. Elzaidi*[a], *Osama Al Suindar*[b,*], *Ling S. Wong*[a], *Nigel M. Williams*[a]

[a] *University Hospital Coventry, Department of General Surgery, Coventry, United Kingdom*
[b] *Alkhamseen Hospital, Department of General Surgery, Sanaa, Yemen*

ARTICLE INFO

Article history:
Received 8 August 2019
Accepted 6 October 2019
Available online 30 October 2019

Keywords:
Anorectal
Benign
Bibliometric
Citations
Classics

ABSTRACT

Background & aim: Bibliometric analysis is used to explore the historical development in a particular field. The aim is to identify and analyse most cited papers in benign anorectal disease in the last 7 decades (1950–2018).

Method: Thomson Reuters Web of Science database was used to find the top 100 cited articles in benign anorectal conditions. Papers were independently extracted by two investigators. The top 100 cited articles were identified and ranked according to number of citations. The articles were then sorted by author, journal, institution, country and publication date. The study subject was divided into 5 groups.

Results: The most frequently cited article received 1307 citations whereas the least cited received 154 citations. The earliest recorded article was published in 1960 and the most recent was from 2010. More than half of the articles addressed faecal incontinence and sphincter related literature (n = 54). The articles were published in 29 different journals. A majority (69%) of manuscripts originated from the USA (n = 35; 9221 citations) and UK (n = 34; 7796 citations). The origin of these top 100 classic papers was from 53 different institutions. St. Mark's Hospital in the UK had the highest number of articles (n = 21), followed by Cleveland clinic (n = 5) and University of Minnesota (n = 5).

Conclusion: The most highly cited manuscripts in benign anorectal disease cover a wide range of topics. Faecal incontinence and sphincter related articles had the highest number of citations. This review serves as a reference for researchers to find the influential papers in this field.

* *Corresponding author.*
E-mail: osama.alsunidar@gmail.com (O.A. Suindar).

https://doi.org/10.1016/j.jcol.2019.10.002

Cem clássicos de citações em doença anorretal benigna: uma análise bibliométrica de sete décadas (1950–2019)

Palavras-chave:
Anorretal
Benigna
Bibliométrica
Citações
Clássicos

RESUMO

Justificativa e objetivo: A análise bibliométrica é usada para explorar o desenvolvimento histórico em um campo específico. O objetivo é identificar e analisar os artigos mais citados em doença anorretal benigna nas últimas 7 décadas (1950–2018).

Método: A base de dados Thomson Reuters Web of Science foi usada para encontrar os 100 artigos mais citados em doenças anorretais benignas. Os artigos foram extraídos de forma independente por dois pesquisadores. Os 100 artigos mais citados foram identificados e classificados de acordo com o número de citações. Os artigos foram classificados por autor, revista médica, instituição, país e data de publicação. Os sujeitos do estudo foram divididos em cinco grupos.

Resultados: O artigo mais citado recebeu 1.307 citações, enquanto o menos citado recebeu 154 citações. O artigo mais antigo foi publicado em 1960 e o mais recente a partir de 2010. Mais da metade dos artigos abordou a incontinência fecal e a literatura relacionada ao esfíncter (n = 54). Os artigos foram publicados em 29 revistas diferentes. A maioria (69%) dos manuscritos é originária dos EUA (n = 35; 9.221 citações) e do Reino Unido (n = 34; 7.796 citações). Os 100 artigos clássicos mais citados são originários de 53 instituições diferentes. O St. Mark's Hospital, no Reino Unido, teve o maior número de artigos (n = 21), seguido pela Clínica de Cleveland (n = 5) e pela Universidade de Minnesota (n = 5).

Conclusão: Os manuscritos mais citados em doença anorretal benigna abrangem uma grande variedade de tópicos. Os artigos relacionados à incontinência fecal e ao esfíncter tiveram o maior número de citações. Esta revisão serve de referência para os pesquisadores encontrarem os artigos influentes nesse campo.

Introduction

The diagnosis and management of benign anorectal conditions represent a significant part of the workload of colorectal surgeons.[1] They are also frequently encountered by community doctors who initially see and assess these patients before hospital referral.[2]

There are landmark publications addressing benign anorectal disease that have made significant contributions to working knowledge and clinical practice. Sadly, many of these studies are not widely known among some clinicians. It would be a useful resource to have these high-impact publications in one source, enabling easy and ready access. High quality studies are more often associated with an increased number of citations.[3] Clinicians often base their decision-making process on findings from high impact studies.[4]

Garfield defines a citation classic as "an individual work which is cited frequently and consistently over time".[5]

Bibliometric analysis is the main tool used to explore the historical development in a particular field. There are more than 140 publications in the literature on the most cited work in different disciplines. The majority of this literature has been produced in the last 5 years. These publications cover citation classics in specialties such as neurology,[6] bariatric surgery,[7,8] and orthopedic surgery.[9]

The importance in defining a citation classic is best explained by Dubin et al. The authors state that, acknowledgement of the most read articles in a certain field, not only emphasize the impact of the distinguished work presented by colleagues in the respective field, but also fulfils our intrigue into the historical developments of that Field.[10]

To date, there is no similar study addressing the most influential papers in benign anorectal disease. In the present consideration, we identify and analyze the top 100 most cited papers on benign anorectal diseases. We have excluded publications on the subject of cancer as this most certainly requires a separate analysis and also is partially covered in a previous work.[11]

Materials and methods

Thomson Reuters Web of Science database was searched on 8th July 2019. The search terms used were: "anus", "anal", "anorectal", "rectal", "rectum", "anal fissure", "fissure-in-ano", "Anal fistula*", "perianal fistula*", "anal sepsis", "hemorrhoid*", "pruritus ani", "rectal prolapse", "procidentia", "rectal intussusception", "rectocele", "proctalgia", "Obstructed defecation", "incontinence", with the use of Boolean operator AND or OR.

The database was searched from the earliest available citation until the present day (1950–2019). Papers on cancer or premalignant conditions (such as AIN, HIV, HPV infections) were excluded.

Table 1 – The top 100 citation classics.

Rank	Article	Nº of citations
1	Jorge JM, Wexner SD. Etiology and management of fecal incontinence. Diseases of the colon & rectum. 1993 Jan 1;36(1):77–97.	1307
2	Sultan AH, Kamm MA, Hudson CN, Bartram CI. Third degree obstetric anal sphincter tears: risk factors and outcome of primary repair. Bmj. 1994 Apr 2;308(6933):887–91.	998
3	Parks AG. ANORECTAL INCONTINENCE. Proceedings of the Royal Society of Medicine-London. 1975;68(11):681–90.	684
4	Rockwood TH, Church JM, Fleshman JW, Kane RL, Mavrantonis C, Thorson AG, Wexner SD, Bliss D, Lowry AC. Patient and surgeon ranking of the severity of symptoms associated with fecal incontinence. Diseases of the colon & rectum. 1999 Dec 1;42(12):1525–31.	638
5	Sultan AH, Kamm MA, Hudson CN, Thomas JM, Bartram CI. Anal-sphincter disruption during vaginal delivery. New England journal of medicine. 1993 Dec 23;329(26):1905–11.	484
6	Abrams P, Andersson KE, Birder L, Brubaker L, Cardozo L, Chapple C, et al., Fourth International Consultation on Incontinence Recommendations of the International Scientific Committee: Evaluation and treatment of urinary incontinence, pelvic organ prolapse and fecal incontinence. Neurourology and Urodynamics: Official Journal of the International Continence Society. 2010 Jan;29(1):213–40.	472
7	Nelson, R., Norton, N., Cautley, E., & Furner, S. (1995). Community-based prevalence of anal incontinence. Jama, 274(7), 559-561.	448
8	Rockwood TH, Church JM, Fleshman JW, Kane RL, Mavrantonis C, Thorson AG, et al., Fecal incontinence quality of life scale. Diseases of the Colon & Rectum. 2000 Jan 1;43(1):9–16.	406
9	Thomson WHF. NATURE OF HEMORRHOIDS. *British Journal of Surgery*. 1975;62(7):542–52.	394
10	Parks AG, Gordon PH, Hardcastle JD. A classification of fistula-in-ano. British Journal of Surgery. 1976 Jan;63(1):1–2.	382
11	Garcia-Olmo D, Herreros D, Pascual I, Pascual JA, Del-Valle E, Zorrilla J, et al., Expanded adipose-derived stem cells for the treatment of complex perianal fistula: a phase II clinical trial. Diseases of the colon & rectum. 2009 Jan 1;52(1):79–86.	367
12	Matzel KE, Stadelmaie U, Gall FP, Hohenfellner M. Electrical stimulation of sacral spinal nerves for treatment of faecal incontinence. The Lancet. 1995 Oct 28;346(8983):1124–7.	355
13	Kiff ES, Swash M. Slowed conduction in the pudendal nerves in idiopathic (neurogenic) faecal incontinence. British Journal of Surgery. 1984 Aug;71(8):614–6.	320
14	Johanson JF, Lafferty J. Epidemiology of fecal incontinence: the silent affliction. American Journal of Gastroenterology. 1996 Jan 1;91(1).	313
15	Schwartz DA, Wiersema MJ, Dudiak KM, Fletcher JG, Clain JE, Tremaine WJ, et al., A comparison of endoscopic ultrasound, magnetic resonance imaging, and exam under anesthesia for evaluation of Crohn's perianal fistulas. Gastroenterology. 2001 Nov 1;121(5):1064–72.	297
16	Parks AG. Pathogenesis and treatment of fistuila-in-ano. British medical journal. 1961;1(5224):463–9.	287
17	Pescatori M, Gagliardi G. Postoperative complications after Procedure for Prolapsed Hemorrhoids (PPH) and Stapled Transanal Rectal Resection (STARR) procedures. Techniques in coloproctology. 2008 Mar 1;12(1):7–19.	277
18	Bharucha AE, Wald A, Enck P, Rao S. Functional anorectal disorders. Gastroenterology. 2006 Apr 1;130(5):1510-8.	271
19	Malouf AJ, Norton CS, Engel AF, Nicholls RJ, Kamm MA. Long-term results of overlapping anterior anal-sphincter repair for obstetric trauma. The Lancet. 2000 Jan 22;355(9200):260–5.	269
20	Sandborn WJ, Fazio VW, Feagan BG, Hanauer SB. AGA technical review on perianal Crohn's disease. Gastroenterology. 2003 Nov 1;125(5):1508–30.	263
21	Parks AG, Swash M, Urich H. Sphincter denervation in anorectal incontinence and rectal prolapse. Gut. 1977 Aug 1;18(8):656–65.	261
22	deVries PA, Pena A. Posterior sagittal anorectoplasty. Journal of pediatric surgery. 1982 Oct;17(5):638.	260
23	Madigan MR, Morson BC. Solitary ulcer of the rectum. Gut. 1969 Nov 1;10(11):871–81.	258
24	Broden B, Snellman B. Procidentia of the rectum studied with cineradiography. Diseases of the Colon & Rectum. 1968 Sep 1;11(5):330.	257
25	Whitehead WE, Borrud L, Goode PS, Meikle S, Mueller ER, Tuteja A, et al., Pelvic Floor Disorders Network. Fecal incontinence in US adults: epidemiology and risk factors. Gastroenterology. 2009 Aug 31;137(2):512–7.	256
26	Morinaga K, Hasuda K, Ikeda T. A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter. American Journal of Gastroenterology. 1995 Apr 1;90(4):610–3.	252
27	Garcia-Aguilar J, Belmonte C, Wong WD, Goldberg SM, Madoff RD. Anal fistula surgery. Diseases of the colon & rectum. 1996 Jul 1;39(7):723–9.	250
28	Brisinda G, Maria G, Bentivoglio AR, Cassetta E, Gui D, Albanese A. A comparison of injections of botulinum toxin and topical nitroglycerin ointment for the treatment of chronic anal fissure. New England Journal of Medicine. 1999 Jul 8;341(2):65–9.	249
29	Frenckner B, Euler CH. Influence of pudendal block on the function of the anal sphincters. Gut. 1975 Jun 1;16(6):482–9.	248
30	Hellers G, Bergstrand O, Ewerth S, Holmström B. Occurrence and outcome after primary treatment of anal fistulae in Crohn's disease. Gut. 1980 Jun 1;21(6):525–7.	245
31	Lund JN, Scholefield JH. Aetiology and treatment of anal fissure. British journal of surgery. 1996 Oct;83(10):1335–44.	244

– Table 1 (*Continued*)

Rank	Article	Nº of citations
32	Johanson JF, Sonnenberg A. The prevalence of hemorrhoids and chronic constipation: an epidemiologic study. Gastroenterology. 1990 Feb 1;98(2):380–6.	243
33	O'Kelly T, Brading A, Mortensen N. Nerve mediated relaxation of the human internal anal sphincter: the role of nitric oxide. Gut. 1993 May 1;34(5):689–93.	238
34	Chan CL, Facer P, Davis JB, Smith GD, Egerton J, Bountra C, et al., Sensory fibres expressing capsaicin receptor TRPV1 in patients with rectal hypersensitivity and faecal urgency. The Lancet. 2003 Feb 1;361(9355):385–91.	234
35	MacRae HM, McLeod RS. Comparison of hemorrhoidal treatment modalities. Diseases of the colon & rectum. 1995 Jul 1;38(7):687–94.	232
36	Duthie HL, Gairns FW. Sensory nerve-endings and sensation in the anal region of man. British Journal of Surgery. 1960 May;47(206):585–95.	232
37	Diamant NE, Kamm MA, Wald A, Whitehead WE. AGA technical review on anorectal testing techniques. Gastroenterology. 1999 Mar 1;116(3):735–60.	226
38	Donnelly V, Fynes M, Campbell D, Johnson H, O'Connell PR, O'Herlihy C. Obstetric events leading to anal sphincter damage. Obstetrics & Gynecology. 1998 Dec 1;92(6):955–61.	219
39	Read NW, Harford WV, Schmulen AC, Read MG, Santa Ana C, Fordtran JS. A clinical study of patients with fecal incontinence and diarrhea. Gastroenterology. 1979 Apr 1;76(4):747–56.	219
40	Duthie HL, Bennett RC. The relation of sensation in the anal canal to the functional anal sphincter: a possible factor in anal continence. Gut. 1963 Jun 1;4(2):179–82.	219
41	Kamm MA. OBSTETRIC DAMAGE AND FECAL INCONTINENCE. *Lancet*. 1994;344(8924):730–3.	217
42	Law PJ, Bartram CI. Anal endosonography: technique and normal anatomy. Gastrointestinal radiology. 1989 Dec 1;14(1):349–53.	217
43	Maria G, Cassetta E, Gui D, Brisinda G, Bentivoglio AR, Albanese A. A comparison of botulinum toxin and saline for the treatment of chronic anal fissure. New England Journal of Medicine. 1998 Jan 22;338(4):217–20.	216
44	Engel BT, Nikoomanesh P, Schuster MM. Operant conditioning of rectosphincteric responses in the treatment of fecal incontinence. New England Journal of Medicine. 1974 Mar 21;290(12):646–9.	215
45	Van Assche G, Vanbeckevoort D, Bielen D, Coremans G, Aerden I, Noman M, et al., Magnetic resonance imaging of the effects of infliximab on perianal fistulizing Crohn's disease. The American journal of gastroenterology. 2003 Feb 1;98(2):332–9.	210
46	Khubchandani IT, Reed JF. Sequelae of internal sphincterotomy for chronic fissure in ano. British journal of surgery. 1989 May;76(5):431–4.	209
47	Neill ME, Parks AG, Swash M. Physiological studies of the anal sphincter musculature in faecal incontinence and rectal prolapse. British Journal of Surgery. 1981 Aug;68(8):531–6.	209
48	Ho YH, Cheong WK, Tsang C, Ho J, Eu KW, Tang CL, Seow-Choen F. Stapled hemorrhoidectomy—cost and effectiveness. Randomized, controlled trial including incontinence scoring, anorectal manometry, and endoanal ultrasound assessments at up to three months. Diseases of the colon & rectum. 2000 Dec 1;43(12):1666–75.	205
49	Law PJ, Kamm MA, Bartram CI. Anal endosonography in the investigation of faecal incontinence. British Journal of Surgery. 1991 Mar;78(3):312–4.	204
50	Pescatori M, Anastasio G, Bottini C, Mentasti A. New grading and scoring for anal incontinence. Diseases of the colon & rectum. 1992 May 1;35(5):482–7.	203
51	D'Hoore A, Cadoni R, Penninckx F. Long-term outcome of laparoscopic ventral rectopexy for total rectal prolapse. British journal of surgery. 2004 Nov;91(11):1500–5.	201
52	Nelson R, Norton N, Cautley E, Furner S. Community-based prevalence of anal incontinence. Jama. 1995 Aug 16;274(7):559–61.	200
53	Sultan AH, Kamm MA, Talbot IC, Nicholls RJ, Bartram CI. Anal endosonography for identifying external sphincter defects confirmed histologically. British journal of surgery. 1994 Mar;81(3):463–5.	195
54	McHugh SM, Diamant NE. Effect of age, gender, and parity on anal canal pressures. Digestive diseases and sciences. 1987 Jul 1;32(7):726–36.	190
55	Read M, Read NW, Barber DC, Duthie HL. Effects of loperamide on anal sphincter function in patients complaining of chronic diarrhea with fecal incontinence and urgency. Digestive diseases and sciences. 1982 Sep 1;27(9):807-14.	190
56	Peña A, Devries PA. Posterior sagittal anorectoplasty: important technical considerations and new applications. Journal of pediatric surgery. 1982 Dec 1;17(6):796–811.	189
57	Wald A, Tunuguntla AK. Anorectal sensorimotor dysfunction in fecal incontinence and diabetes mellitus: modification with biofeedback therapy. New England Journal of Medicine. 1984 May 17;310(20):1282–7.	188
58	Macmillan AK, Merrie AE, Marshall RJ, Parry BR. The prevalence of fecal incontinence in community-dwelling adults: a systematic review of the literature. Diseases of the colon & rectum. 2004 Sep 1;47(9):1341–9.	185
59	Rothbarth J, Bemelman WA, Meijerink WJ, Stiggelbout AM, Zwinderman AH, Buyze-Westerweel ME, Delemarre JB. What is the impact of fecal incontinence on quality of life?. Diseases of the colon & rectum. 2001 Jan 1;44(1):67–71.	184
60	Burkitt DP. Varicose veins, deep vein thrombosis, and haemorrhoids: epidemiology and suggested aetiology. British Medical Journal. 1972 Jun 3;2(5813):556.	184
61	Irvine EJ. Usual therapy improves perianal Crohn's disease as measured by a new disease activity index. McMaster IBD Study Group. Journal of clinical gastroenterology. 1995 Jan;20(1):27–32.	183

– Table 1 (*Continued*)

Rank	Article	Nº of citations
62	Rutter KR, Riddell RH. The solitary ulcer syndrome of the rectum. Clinics in gastroenterology. 1975 Sep;4(3):505–30.	182
63	Handa VL, Danielsen BH, Gilbert WM. Obstetric anal sphincter lacerations. Obstetrics & Gynecology. 2001 Aug 1;98(2):225–30.	177
64	Schouten WR, Briel JW, Auwerda JJ. Relationship between anal pressure and anodermal blood flow. Diseases of the colon & rectum. 1994 Jul 1;37(7):664–9.	174
65	Leigh R, Turnberg L. Faecal incontinence: the unvoiced symptom. The Lancet. 1982 Jun 12;319(8285):1349–51.	174
66	Rattan S, Chakder SU. Role of nitric oxide as a mediator of internal anal sphincter relaxation. American Journal of Physiology-Gastrointestinal and Liver Physiology. 1992 Jan 1;262(1):G107–12.	173
67	Sonoda T, Hull T, Piedmonte MR, Fazio VW. Outcomes of primary repair of anorectal and rectovaginal fistulas using the endorectal advancement flap. Diseases of the colon & rectum. 2002 Dec 1;45(12):1622–8.	172
68	Johnson EK, Gaw JU, Armstrong DN. Efficacy of anal fistula plug vs. fibrin glue in closure of anorectal fistulas. Diseases of the colon & rectum. 2006 Mar 1;49(3):371–6.	171
69	Cerulli MA, Nikoomanesh P, Schuster MM. Progress in biofeedback conditioning for fecal incontinence. Gastroenterology. 1979 Apr 1;76(4):742-6.	171
70	McCue JL, Thomson JP. Clinical and functional results of abdominal rectopexy for complete rectal prolapse. British journal of surgery. 1991 Aug;78(8):921–3.	170
71	Wexner SD, Marchetti F, Jagelman DG. The role of sphincteroplasty for fecal incontinence reevaluated: a prospective physiologic and functional review. Diseases of the colon & rectum. 1991 Jan 1;34(1):22–30.	168
72	Baeten CG, Konsten J, Soeters PB, Spaans F, Visser R, Habets AM, Bourgeois IM, Wagenmakers AJ. Dynamic graciloplasty for treatment of faecal incontinence. The Lancet. 1991 Nov 9;338(8776):1163–5.	168
73	Engel AF, Kamm MA, Sultan AH, Bartram CI, Nicholls RJ. Anterior anal sphincter repair in patients with obstetric trauma. British Journal of Surgery. 1994 Aug;81(8):1231–4.	167
74	Beets-Tan RG, Beets GL, van der Hoop AG, Kessels AG, Vliegen RF, Baeten CG, van Engelshoven JM. Preoperative MR imaging of anal fistulas: does it really help the surgeon?. Radiology. 2001 Jan;218(1):75–84.	166
75	Bleday R, Pena JP, Rothenberger DA, Goldberg SM, Buls JG. Symptomatic hemorrhoids: current incidence and complications of operative therapy. Diseases of the colon & rectum. 1992 May 1;35(5):477–81.	166
76	Leroi AM, Parc Y, Lehur PA, Mion F, Barth X, Rullier E, et al., Efficacy of sacral nerve stimulation for fecal incontinence: results of a multicenter double-blind crossover study. Annals of surgery. 2005 Nov;242(5):662.	165
77	Boccasanta P, Venturi M, Stuto A, Bottini C, Caviglia A, Carriero A, et al., Stapled transanal rectal resection for outlet obstruction: a prospective, multicenter trial. Diseases of the colon & rectum. 2004 Sep 1;47(9):1285–97.	165
78	Norton C, Chelvanayagam S, Wilson-Barnett J, Redfern S, Kamm MA. Randomized controlled trial of biofeedback for fecal incontinence. Gastroenterology. 2003 Nov 1;125(5):1320–9.	164
79	Jost WH. One hundred cases of anal fissure treated with botulin toxin. Diseases of the colon & rectum. 1997 Sep 1;40(9):1029–32.	164
80	Nyam DC, Pemberton JH. Long-term results of lateral internal sphincterotomy for chronic anal fissure with particular reference to incidence of fecal incontinence. Diseases of the colon & rectum. 1999 Oct 1;42(10):1306-10.	164
81	Vaizey CJ, Kamm MA, Turner IC, Nicholls RJ, Woloszko J. Effects of short term sacral nerve stimulation on anal and rectal function in patients with anal incontinence. Gut. 1999 Mar 1;44(3):407–12.	162
82	Bannister JJ, Abouzekry L, Read NW. Effect of aging on anorectal function. Gut. 1987 Mar 1;28(3):353–7.	162
83	Barron J. Office ligation of internal hemorrhoids. The American Journal of Surgery. 1963 Apr 1;105(4):563-70.	162
84	Loungnarath R, Dietz DW, Mutch MG, Birnbaum EH, Kodner IJ, Fleshman JW. Fibrin glue treatment of complex anal fistulas has low success rate. Diseases of the colon & rectum. 2004 Apr 1;47(4):432–6.	161
85	Halverson AL, Hull TL. Long-term outcome of overlapping anal sphincter repair. Diseases of the colon & rectum. 2002 Mar 1;45(3):345–8.	161
86	Beersiek F, Parks AG, Swash M. Pathogenesis of ano-rectal incontinence: a histometric study of the anal sphincter musculature. Journal of the neurological sciences. 1979 Jun 1;42(1):111–27	160
87	Tjandra JJ, Chan MK. Systematic review on the procedure for prolapse and hemorrhoids (stapled hemorrhoidopexy). Diseases of the colon & rectum. 2007 Jun 1;50(6):878–92.	159
88	Rojanasakul A, Pattanaarun J, Sahakitrungruang C, Tantiphlachiva K. Total anal sphincter saving technique for fistula-in-ano; the ligation of intersphincteric fistula tract. JOURNAL-MEDICAL ASSOCIATION OF THAILAND. 2007 Mar 1;90(3):581.	159
89	Buchanan GN, Halligan S, Bartram CI, Williams AB, Tarroni D, Cohen CR. Clinical examination, endosonography, and MR imaging in preoperative assessment of fistula in ano: comparison with outcome-based reference standard. Radiology. 2004 Dec;233(3):674–81.	159
90	Nelson RL. Epidemiology of fecal incontinence. Gastroenterology. 2004 Jan 1;126:S3–7.	159
91	Rao SS, Hatfield R, Soffer E, Rao S, Beaty J, Conklin JL. Manometric tests of anorectal function in healthy adults. The American journal of gastroenterology. 1999 Mar 1;94(3):773-83.	159
92	Champagne BJ, O'Connor LM, Ferguson M, Orangio GR, Schertzer ME, Armstrong DN. Efficacy of anal fistula plug in closure of cryptoglandular fistulas: long-term follow-up. Diseases of the colon & rectum. 2006 Dec 1;49(12):1817–21.	158
93	Lund JN, Scholefield JH. A randomised, prospective, double-blind, placebo-controlled trial of glyceryl trinitrate ointment in treatment of anal fissure. The Lancet. 1997 Jan 4;349(9044):11–4.	158

– Table 1 (*Continued*)

Rank	Article	Nº of citations
94	Whiteford MH, Kilkenny J, Hyman N, Buie WD, Cohen J, Orsay C, et al., Practice parameters for the treatment of perianal abscess and fistula-in-ano (revised). Diseases of the colon & rectum. 2005 Jul 1;48(7):1337–42.	156
95	Fenner DE, Genberg B, Brahma P, Marek L, DeLancey JO. Fecal and urinary incontinence after vaginal delivery with anal sphincter disruption in an obstetrics unit in the United States. American journal of obstetrics and gynecology. 2003 Dec 1;189(6):1543–9.	156
96	Rosen HR, Urbarz C, Holzer B, Novi G, Schiessel R. Sacral nerve stimulation as a treatment for fecal incontinence. Gastroenterology. 2001 Sep 1;121(3):536–41.	156
97	Browning GG, Parks AG. Postanal repair for neuropathic faecal incontinence: correlation of clinical result and anal canal pressures. British Journal of Surgery. 1983 Feb;70(2):101–4.	156
98	Williams JG, MacLeod CA, Rothenberger DA, Goldberg SM. Seton treatment of high anal fistulae. British journal of surgery. 1991 Oct;78(10):1159–61.	154
99	Wexner SD, Coller JA, Devroede G, Hull T, McCallum R, Chan M, et al., Sacral nerve stimulation for fecal incontinence: results of a 120-patient prospective multicenter study. Annals of surgery. 2010 Mar 1;251(3):441.	154
100	Bennett RC, Duthie HL. The functional importance of the internal anal sphincter. British Journal of Surgery. 1964 May 1;51(5):355–7.	154

Table 2 – Main fields of articles.

Field	Number of articles
Fecal incontinence and sphincter related studies	54
Perianal Fistulas and anal sepsis	18
Hemorrhoids	10
Anal Fissures	11
Rectal prolapse, Solitary ulcer and obstructed defecation	7

The first two authors screened and extracted the papers independently. After consensus, the full text of all chosen articles was obtained for analysis.

The 100 most cited papers were retrieved and ranked according to the number of citations in descending order (Table 1).

The full text of all chosen articles was obtained for further analysis. The compiled 100 articles were then sorted by author, journal, institution, country, and publication date.

The study subject was divided into five groups: Fecal Incontinence and sphincter related studies, anal fissures, hemorrhoids, perianal fistula and sepsis and functional disorders except fecal incontinence (rectal prolapse, solitary ulcer and obstructed defecation).

Results

Analysis of the 100 articles under consideration (Table 1 shows the ranking in descending order) revealed that the most frequently cited article received 1307 citations whereas the least cited received 154 citations. More than half of the articles addressed fecal incontinence and sphincter-related literature (n = 54). Table 2 shows the number of articles for each subject.

The earliest recorded article was published in 1960 and the most recent was from 2010. The years in which the highest number of citations was published were 1999 and 2004. There was a steady increase in the number of articles across the decades that peaked in the 1990s and 2000s (34 and 33 articles respectively).

The latest publication (nº 99, 2010) in the citation classics is on “Sacral nerve stimulation for fecal incontinence: results of a 120 patient prospective multicenter study.” Whereas the oldest article (nº 36, 1960) was on “Sensory nerve-endings and sensation in the anal region of man”.

Table 3 – Top 6 journals with largest number of citations.

Source titles	Records	Number of citations	Impact factor
Disease of the Colon and Rectum	23	6,359	3.6
British journal of Surgery	15	3,647	5.4
Gastroenterology	11	2,463	20.7
Gut	8	1,841	17
Lancet	7	1,662	53
New England Journal of Medicine	5	1,869	79

Table 4 – Top countries of origin.

Country	Number
USA	35
UK	34
ITALY	5
Netherlands	4
Canada	4
Sweden	3
Belgium	2
Germany	2

The top 100 articles were published in 29 different journals. 69 of the 100 articles were published in 6 Journals (Table 3). DCR and BJS are the top two journals with 23 and 15 publications respectively.

A majority (69%) of manuscripts originated from the USA (n = 35; 9221 citations) and UK (n = 34; 7796 citations). Table 4 displays the top 8 countries of origin.

The origin of these top 100 classic papers was from 53 different institutions. St. Mark’s Hospital in the UK had the highest number of articles (n = 21), followed by Cleveland clinic (n = 5) and University of Minnesota (n = 5). The leading 5 institutions are shown in Table 5.

Table 5 – Top institutions.

Institution	Records
St Marks Hospital-London	21
Cleveland Clinic	5
University of Minnesota	5
Mayo Clinic	3
University of Illinois	3

Kamm was the most cited author with 10 publications and 3126 citations, followed by Wexner with 5 publications and 2673 citations. Table 6 shows the most frequent authors cited.

The number of authors of these manuscripts ranged from 1 to 36 with a median of 4.5 per manuscript.

Discussion

Impact factor has always been the metric used to assess the quality of published research. It has been used since 1955.[12] This has led to a skewed focus on impact factor that has made some compare it to a disease "impactitis".[13] Garfield suggests citation count as an alternative indicator of the quality of an article as a way to assess its impact. He introduced the concept of "citation classics".[14]

We have found that most of the classics in this field were published between 1990 and 2010, an observation similar to citation classics in other medical fields.[15,16] This is in contrast to the belief that older papers have more time to be cited.[17] It appears that the classics gradually get fewer citations as their substance gets absorbed by current knowledge. This phenomenon is termed "obliteration by incorporation".[18]

An interesting observation in the current analysis is that the 2 journals with the highest number of cited articles (38 from the 100 list) also had the lowest impact factors (DCR, 3.6; BJS 5.4) among the most cited 7 journals (Table 3). This is unlike the pattern observed in other reviews where impact factor was a strong predictor of citation frequency.[8,15,19] Those journals with very high impact factors (NEJM, Lancet, BMJ, Gastroenterology and Gut) represent only one third of the top 100 publications (n = 33).

USA and UK are the 2 countries at the forefront of anorectal research. More than two-thirds of the articles (n = 69) originated from these 2 countries. This might reflect better funding and high quality research that was conducted in eminent institutions such as St Marks Hospital in London and Cleveland Clinic in Florida. The authors received the highest citation numbers (Table 6) also reflected that. It must also be emphasized that the search was restricted to publications in the English language.

Seven authors contribute to at least 4 classics (Table 6). These 7 authors are all contemporary apart from Sir Alan Parks (1920–1982) whose paper on the classification of fistula-in-ano is still one of the most important cited classics (nº 3) despite being published more than 4 decades ago. All these authors are from St Marks, London except Wexner who is based in Cleveland Clinic, Florida.

The average number of authors per article has seen sustained rise over the years. For example, there are 2 articles from 2010 (nº 6 & 99) which had 36 and 19 authors respectively. This might be explained by increased multicenter collaboration.

Fecal incontinence

The most cited article in this field is a comprehensive review of fecal incontinence by Jorge and Wexner (nº 1). It is highly cited because it provides an overview of the pathophysiology, etiology and management of fecal incontinence. This reflects the importance of fecal incontinence and its complexity. Maybe one of the important reasons for the numerous citations is the inclusion of the Wexner score of fecal incontinence which was first published in this article. Sacral Nerve Stimulation (SNS) is not included in the management options outlined in the article as this pre-dated the era when SNS was widely accepted as a management option.

The highest number of articles on fecal incontinence were experimental and physiological studies (n = 14) of the sphincter complex and its innervations (nº 10, 13, 21, 26, 29, 34, 36, 40, 47, 57, 70, 82, 86, 100). All of these studies bar one (nº 34) are from the 1960's, 1970's and 1980's. This makes perfect sense, as these papers represent the early attempts to understand the pathophysiology of the anal sphincter complex as well as its abnormalities.

There were 8 classics on obstetric-related anal sphincter injuries and its prevalence (nº 2, 5, 19, 38, 41, 63, 95 & 99). Sultan et al. (nº 2 & 5) highlighted the prevalence of occult sphincter damage and underlying risk factors. Sphincter-related surgical procedures and repairs were covered in 7 articles (nº 22, 72, 73, 85 and 97). Halverson (nº 85) documented the disappointing long-term results of sphincter repair, as more than half of patients remain incontinent to liquid or solid stool.

Six classics addressed the epidemiology of fecal incontinence. This reflects how little was appreciated about the severity of the problem (nº 7, 14, 25, 58, 65 & 90). These classics

Table 6 – Most frequent authors and their institutions.

Authors	Records	Position on the authors' list	Citations	Institution
Kamm MA	10	First author – 1, Second author – 7, Last author – 2	3126	St Marks, UK
Bartram CI	7	Third author – 1, Fourth author – 1, Last author –5	2426	St Marks, UK
Parks AG	7	First author – 4, Second author – 2, Last author – 1	2161	St Marks, UK
Wexner SD	5	First author – 2, Seventh author – 2, last author – 1	2673	Cleveland, USA
Nicholls RJ	4	Fourth author – 3, Last author – 1	793	St Marks, UK
Sultan AH	4	First author – 3, Third author – 1	1846	St Marks, UK
Swash M	4	Second author – 2, Last author – 2	1325	St Marks, UK

highlighted the prevalence of the problem in normal population (nº 7 & 25) and institutionalized patients (nº 90).

SNS as a subject first appeared in this list in 1995. The seminal paper by Matzel et al. (nº 12) demonstrated how electrostimulation to the sacral spinal nerves could increase function of the striated muscles of the anal sphincter. After that, further publications verified the effectiveness of SNS (nº 71, 76, 81 & 96). A recent Cochrane review demonstrated evidence that SNS can improve continence in a proportion of patients with fecal incontinence.[20]

There were three classics concerning biofeedback (nº 44, 52 & 69). One of them was a RCT (nº 52). The hypothesis that biofeedback would enhance the therapeutic effect compared with standard care with advice was not upheld.

There were 4 classics focusing on scoring and Quality of Life (QoL) in fecal incontinence patients (nº 4, 8, 50 & 59). Despite the popularity of the St Mark's scoring system,[21] it hasn't made it into the classics list.

Anal fistulas & sepsis

There were 18 classics of the top 100 addressing anal fistulas and sepsis. The seminal paper by Park in 1976 (nº 3) is a highly cited paper as it was the first in the literature to propose a classification for anal fistulas which was widely accepted. This standard classification has made it possible to compare results from different institutions using the same system.

There are 3 classics on the use of anal fistula plug and fibrin glue in the management anal fistulas. They clearly showed that biologic anal plug is effective and more reliable than fibrin glue closure. Despite the initial encouraging results of using an anal fistula plug, the success rates could not be reproduced and most subsequent healing rates were below 50% with some as low as 24%.[22–25] In a recent UK multicenter study, similar clinical fistula healing rates were observed at 12 months' follow-up (plug 54% vs. surgeon's preference 57%).[26]

There were 2 classics on subjects which were "hot" at the time and then became less popular.

One of these concerns LIFT (Ligation of Intersphincteric Fistula Tract) procedure (nº 88). This procedure gained popularity because it appeared to be associated with less functional compromise than some traditional treatments of transsphincteric fistulas. The reported initial results were very encouraging (94.4% success rate). These results could not be subsequently reproduced.

The other subject concerned the use of adipose stem cells in anal fistulas. This article is high on the list (nº 11). Subsequent studies showed disappointing results with a healing rate of 33% at 3 years.[27] Another study showed that healing rates were not superior to fibrin adhesive.[28]

Hemorrhoids

The highest-ranking paper addressing hemorrhoidal disease is 9th on the list. This was an anatomical and clinical study of the nature of hemorrhoids by Thomson (1975).

New emerging procedures for hemorrhoids are also the subject of a few classics. These are stapled hemorrhoidopexy (nº 48 & 87) and Hemorrhoidal Artery Ligation (HAL) (nº 54).

When hemorrhoidpexy first appeared it was an attractive proposition especially for prolapsing hemorrhoids. However, later on it was found to have several unique complications, such as rectovaginal fistula, staple line bleeding, and stricture at the staple line. A recent systematic review found a median complication rate of 16.1%, with 5 mortalities documented.[29] Between 2000 and 2009, there were 40 cases published documenting rectal perforation after stapled hemorrhoidopexy. Thirty-five patients required a laparotomy with fecal diversion, and one patient was treated by low anterior resection.[30]

HAL acquired popularity due to its minimally invasive nature and less postoperative pain (nº 54) compared to hemorrhoidoexy and surgical hemorrhoidectomy. Because of that it was welcomed despite the extra cost associated. However, a recent well-designed multicenter RCT was published comparing RBL (Rubber Band Ligation) with HAL for the treatment of Grade II and III hemorrhoids. The RBL group needed additional procedures compared to the HAL group. However, recurrence rates, symptom scores, complications, QoL and continence score were similar, although patients had more pain in the early postoperative period after HAL. HAL was found, as expected, to be more expensive and was not found to be cost-effective compared with RBL.[31]

Anal fissures

The majority of the classics addressing anal fissures covered the pathophysiology and pathogenesis of anal fissures. Botox and GTN treatments were the subjects of 4 classics (nº 28, 31, 43 & 79). They proved the effectiveness of both treatments, however, Botox was superior. In a recent meta-analysis: Botox was associated with fewer side effects than GTN, but there was no difference in fissure healing or recurrence.[32]

Rectal prolapse, solitary ulcer and obstructed defecation

There were seven classics in this field. Since the classic paper on Cineradiography in 1968 by Brodon (nº 24), the next paper to receive similar attention was the study by A. D'Hoore (2004) (nº 51) describing Laparoscopic Ventral Mesh Rectopexy (LVMR). This was the only paper describing a procedure for rectal prolapse which made it to the top 100 list. LVMR has gained popularity by colorectal surgeons.[33] Despite the wide acceptance of this procedure in Europe and the acceptance of its short and long-term complications, it is still not widely approved in the in the United States given the limited data on long-term efficacy when compared with more traditional approaches and the possibility of mesh-related complications.[34]

Limitations of this study

As in previous reports, we choose to address the top 100 cited papers in this field. There is no scientific rationale for this but is an accepted formula.[8,15]

There are some inherent potential biases in bibliometric analyses. Some articles may receive citations because of the reputation of the publishing institution or from self-citation.

Also, some journals tend to cite their own papers in order to improve their impact factor.[35]

Conclusion

This review provides a comprehensive analysis of the 100 most cited articles on the subject of benign anorectal disease. The articles cover a period of over 50 years (1960–2010). The most highly cited manuscripts in benign anorectal disease cover a wide range of topics. Fecal incontinence and sphincter-related articles had the highest number of citations. The three main proctology diseases (fistulas, hemorrhoids and fissures) had comparable weights in representations. Pelvic floor disorders, apart from fecal incontinence, were least represented. This review serves as a reference for researchers to find the influential papers in this field.

Contribution

Design, acquisition of data and analysis: Hureibi & Elzaidi.
Drafting the article: Hureibi, Alsuindar & Elzaidi.
Critical revision of the draft: Wong & Williams.
Final approval of the version to be published: Hureibi, Elzaidi, Wong and Williams.

Funding/support

None reported.

Financial disclosures

None reported.

Conflicts of interest

The authors declare no conflicts of interest.

REFERENCES

1. Sud A, Khan A. Benign anal conditions: haemorrhoids, fissures, perianal abscess, fistula-in-ano and pilonidal sinus. Surgery (Oxford). 2014;32:421–6.
2. Nelson RL, Abcarian H, Davis FG, Persky V. Prevalence of benign anorectal disease in a randomly selected population. Dis Colon Rectum. 1995;38:341–4.
3. Moed HF. The impact-factors debate: the ISI's uses and limits. Nature. 2002;415:731.
4. Sackett DL, Rosenberg WM, Gray JM, Haynes RB, Richardson WS. Evidence based medicine: what it is and what it isn't. In: Editor ed, editor. Book Evidence based medicine: what it is and what it isn't. City. British Medical Journal Publishing Group; 1996.
5. Garfield E. The 100 most-cited papers ever and how we select citation-classics. In: Current Contents; 1984. p. 3–9.
6. Kim JE, Park KM, Kim Y, Yoon DY, Bae JS. Citation classics in central nervous system inflammatory demyelinating disease. Brain Behav. 2017;7(6):e00700.
7. Nowrouzi-Kia B, Chidu C, Carter L, McDougall A, Casole J. The top cited articles in occupational therapy: a citation analysis study. Scand J Occup Ther. 2018;25:15–26.
8. Ahmad SS, Ahmad SS, Kohl S, Ahmad S, Ahmed AR. The hundred most cited articles in bariatric surgery. Obes Surg. 2015;25:900–9.
9. Gheiti AJC, Downey RE, Byrne DP, Molony DC, Mulhall KJ. The 25 most cited articles in arthroscopic orthopaedic surgery. Arthroscopy. 2012;28:548–64.
10. Dubin D, Häfner AW, Arndt KA. Citation classics in clinical dermatologic journals: citation analysis, biomedical journals, and landmark articles, 1945–1990. Arch Dermatol. 1993;129:1121–9.
11. Wrafter PF, Connelly TM, Khan J, Devane L, Kelly J, Joyce WP. The 100 most influential manuscripts in colorectal cancer: a bibliometric analysis. Surgeon. 2016;14:327–36.
12. Garfield E. Citation indexes for science. A new dimension in documentation through association of ideas. Int J Epidemiol. 2006;35:1123–7.
13. Casadevall A, Fang FC. Impacted science: impact is not importance. In: Editor ed, editor. Book Impacted science: impact is not importance. City: Am Soc Microbiol; 2015.
14. Garfield E. What is a citation classic. In: Current Contents; 2013.
15. Brandt J, Downing A, Howard D, Kofinas J, Chasen S. Citation classics in obstetrics and gynecology: The 100 Most Frequently Cited Journal Articles in the Last 50 Years. Obstet Anesth Digest. 2011;31:148.
16. Ibrahim GM, Carter Snead O, Rutka JT, Lozano AM. The most cited works in epilepsy: Trends in the "Citation Classics". Epilepsia. 2012;53:765–70.
17. Picknett T, Davis K. The 100 most-cited articles from JMB. J Mol Biol. 1999;293:171–4.
18. Garfield E. 100 citation classics from the Journal of the American Medical Association. JAMA. 1987;257:52–9.
19. Ponce FA, Lozano AM. Highly cited works in neurosurgery. part ii: the citation classics: A review. J Neurosurg. 2010;112:233–46.
20. Thaha MA, Abukar AA, Thin NN, Ramsanahie A, Knowles CH. Sacral nerve stimulation for faecal incontinence and constipation in adults. Cochrane Database Syst Rev. 2015;(8):CD004464.
21. Vaizey C, Carapeti E, Cahill J, Kamm M. Prospective comparison of faecal incontinence grading systems. Gut. 1999;44:77–80.
22. Lewis R, Lunniss P, Hammond T. Novel biological strategies in the management of anal fistula. Colorectal Dis. 2012;14:1445–55.
23. Ortiz H, Marzo J, Ciga M, Oteiza F, Armendáriz P, de Miguel M. Randomized clinical trial of anal fistula plug versus endorectal advancement flap for the treatment of high cryptoglandular fistula in ano. Br J Surg. 2009;96: 608–12.
24. Ellis CN, Rostas JW, Greiner FG. Long-term outcomes with the use of bioprosthetic plugs for the management of complex anal fistulas. Dis Colon Rectum. 2010;53:798–802.
25. Adamina M, Ross T, Guenin M, Warschkow R, Rodger C, Cohen Z, et al. Anal fistula plug: a prospective evaluation of success, continence and quality of life in the treatment of complex fistulae. Colorectal Dis. 2014;16:547–54.
26. Williams G, Williams A, Tozer P, Phillips R, Ahmad A, Jayne D, et al. The treatment of anal fistula: second ACPGBI Position Statement–2018. Colorectal Dis. 2018;20:5–31.
27. Guadalajara H, Herreros D, De-La-Quintana P, Trebol J, Garcia-Arranz M, Garcia-Olmo D. Long-term follow-up of patients undergoing adipose-derived adult stem cell administration to treat complex perianal fistulas. Int J Colorectal Dis. 2012;27:595–600.

28. Herreros M, Garcia-Arranz M, Guadalajara H, De-La-Quintana P, Garcia-Olmo D. Autologous expanded adipose-derived stem cells for the treatment of complex cryptoglandular perianal fistulas: a phase III randomized clinical trial (FATT 1 fistula Advanced Therapy Trial 1) and long-term evaluation. Dis Colon Rectum. 2012;55:762–72.
29. Porrett LJ, Porrett JK, Ho Y-H. Documented complications of staple hemorrhoidopexy: a systematic review. Int Surg. 2015;100:44–57.
30. Faucheron JL, Voirin D, Abba J. Rectal perforation with life-threatening peritonitis following stapled haemorrhoidopexy. Br J Surg. 2012;99:746–53.
31. Brown SR, Tiernan JP, Watson AJ, Biggs K, Shephard N, Wailoo AJ, et al. Haemorrhoidal artery ligation versus rubber band ligation for the management of symptomatic second-degree and third-degree haemorrhoids (HubBLe): a multicentre, open-label, randomised controlled trial. Lancet. 2016;388:356–64.
32. Sahebally SM, Meshkat B, Walsh SR, Beddy D. Botulinum toxin injection vs. topical nitrates for chronic anal fissure: an updated systematic review and meta-analysis of randomized controlled trials. Colorectal Dis. 2018;20:6–15.
33. Newman PA, Dixon T. Laparoscopic ventral mesh rectopexy: A standardised 14 modular approach. Laparosc Colorectal Surg Lapco Manual. 2017:195.
34. Bordeianou L, Paquette I, Johnson E, Holubar SD, Gaertner W, Feingold DL, et al. Clinical practice guidelines for the treatment of rectal prolapse. Dis Colon Rectum. 2017;60:1121–31.
35. Hansson S. Impact factor as a misleading tool in evaluation of medical journals. Lancet. 1995;346:906.