National Institute for Health and Care Excellence

Consultation

Diverticular disease

L. Evidence review: the management of complicated acute diverticulitis – extent of colectomy

NICE guideline

Intervention evidence review

June 2019

Draft for Consultation

This evidence review was developed by the National Guideline Centre

Disclaimer

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or service users. The recommendations in this guideline are not mandatory and the guideline does not override the responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and, where appropriate, their carer or guardian.

Local commissioners and providers have a responsibility to enable the guideline to be applied when individual health professionals and their patients or service users wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with compliance with those duties.

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1 Management of acute diverticulitis

1.1 Review question: What is the most appropriate extent of colectomy in people with complicated acute diverticulitis?

1.2 Introduction

Over the last decade there have been marked changes in the surgical management of patients with complications of acute complicated diverticular disease. Resections are now frequently undertaken laparoscopically with the use of laparoscopic lavage in the emergency setting. The thresholds for elective resection after recurrent episodes of acute diverticulitis have changed with a greater focus on tailored decision making with the patient. There have been alterations to the threshold for primary anastomosis especially in the emergency setting. This review of the evidence aimed to provide information for both clinicians and patient on what were the clinically and cost effective surgical approaches to the management of acute complicated diverticular disease.

1.3 PICO table

For full details see the review protocol in appendix A.

Table 1: PICO characteristics of review question

Population	Adults 18 years and over with complicated acute diverticulitis
Intervention	Colectomy/bowel resection
Comparisons	Different extents of colectomy as reported by studies

Outcomes	**Critical outcomes:**
	• Quality of life
	• Mortality
	• Morbidity
	• Progression of disease
	• Complications:
	  ○ -infections
	  ○ -abscesses
	  ○ -perforation
	  ○ -fistula
	  ○ -stricture
	• Recurrence rates of acute diverticulitis
	• Hospitalisation
	• Need for further surgery
	• Anastomotic leak rate
	
	Important outcomes:
	Symptom control/recurrence, for example pain relief, bowel habit

Study design	Randomised controlled trials (RCTs), systematic reviews of RCTs. If no RCT evidence is available, search for observational studies

1.4 Clinical evidence

1.4.1 Included studies

No studies were included in the review. See the study selection flow chart in appendix C.

1.4.2 Excluded studies

See the excluded studies list in appendix H.

1.5 Economic evidence

1.5.1 Included studies

No relevant health economic studies were identified.

See also the health economic study selection flow chart in appendix G.

1.5.2 Excluded studies

No health economic studies that were relevant to this question were excluded due to assessment of limited applicability or methodological limitations.

See also the health economic study selection flow chart in appendix G.

1.6 Evidence statements

1.6.1 Clinical evidence statements

No relevant published evidence was identified.

1.6.2 Health economic evidence statements

No relevant published evidence was identified.

1.7 Recommendations

L1. In people undergoing resection of the colon, consider resecting back to compliant bowel.

1.8 Rationale and impact

1.8.1 Why the committee made the recommendations

No evidence was found on the extent of colectomy for people with acute diverticuitis. A recommendation was developed based on the experience of the surgeons on the committee. Committee members discussed the difference between resecting back to normal bowel and resecting back to compliant bowel. The committee agreed that ‘normal bowel’ could be interpreted by some as bowel without diverticuli, rather than bowel with normal structure. To avoid this confusion, resecting back to compliant bowel, which refers to bowel that is functional and is not restricted in terms of movement, was included in the consensus recommendation and reflects the current advice by national bodies.

1.8.2 Impact of the recommendations on practice

The recommendation reflects current practice.

1.9 The committee's discussion of the evidence

1.9.1 Interpreting the evidence

1.9.1.1 The outcomes that matter most

The most critical outcomes identified by the committee for this review were quality of life, mortality, morbidity, progression of disease, complications (infections, abscesses, perforation, fistula and stricture), recurrence rate of acute diverticulitis, hospitalisation, need for further surgery and anastomotic leak rate. Symptom control/recurrence was identified as an important outcome. However no evidence was identified for this review.

1.9.1.2 The quality of the evidence

No evidence was identified for this review.

1.9.1.3 Benefits and harms

Due to the lack of evidence available for this review, a consensus recommendation was made by the committee.

The committee discussed the difference between resecting back to normal bowel and resecting back to compliant bowel, highlighting that using the term 'normal bowel' could lead to different interpretations by different surgeons. The committee explained that 'normal bowel' could be interpreted by some as bowel without diverticula, rather than bowel with normal structure. To avoid this confusion, resecting back to compliant bowel was included in the consensus recommendation. 'Compliant bowel' refers to bowel that is functional and is not restricted in terms of movement.

It was noted that the presence of diverticula in the remaining bowel following resection was not considered a problem, but that diverticula should not be present in the anastomosis as this may increase the likelihood of anastomotic leak.

1.9.2 Cost effectiveness and resource use

No evidence of clinical or cost effectiveness was found, so a recommendation was made by the committee based on clinical experience. The recommendation is not expected to change the cost of surgery.

1.9.3 Other factors the committee took into account

References

1. Abbass MA, Tsay AT, Abbas MA. Laparoscopic resection of chronic sigmoid diverticulitis with fistula. Journal of the Society of Laparoendoscopic Surgeons. 2013; 17(4):636-40

2. Abedi N, McKinlay R, Park A. Laparoscopic colectomy for diverticulitis. Current Surgery. 2004; 61(4):366-9

3. Ambrosetti P, Francis K, Weintraub D, Weintraub J. Functional results following elective laparoscopic sigmoidectomy after CT-proven diagnosis of acute diverticulitis evaluation of 43 patients and review of the literature. Journal of Gastrointestinal Surgery. 2007; 11(6):767-72

4. Blitzer DN, Davis JM, Ahmed N, Kuo YH, Kuo YL. Impact of procedure on the post-operative infection risk of patients after elective colon surgery. Surgical Infections. 2014; 15(6):721-5

5. Boermeester MA, Humes DJ, Velmahos GC, Soreide K. Contemporary review of risk-stratified management in acute uncomplicated and complicated diverticulitis. World Journal of Surgery. 2016; 40(10):2537-45

6. Botsford TW, Zollinger RM, Jr., Hicks R. Mortality of the surgical treatment of diverticulitis. American Journal of Surgery. 1971; 121(6):702-5

7. Boulez J, Espalieu P, Fontaumard E, Meeus P. Laparoscopic colo-rectal surgery: analysis of 113 cases. Hepato-Gastroenterology. 1997; 44(13):40-4

8. Carpenter WS, Allaben RD, Kambouris AA. Fistulas complicating diverticulitis of the colon. Surgery, Gynecology and Obstetrics. 1972; 134(4):625-8

9. Chiu PW, Lam CY, Chow TL, Kwok SP. Conservative approach is feasible in the management of acute diverticulitis of the right colon. ANZ Journal of Surgery. 2001; 71(11):634-6

10. Cima RR, Pendlimari R, Holubar SD, Pattana-Arun J, Larson DW, Dozois EJ et al. Utility and short-term outcomes of hand-assisted laparoscopic colorectal surgery: a single-institution experience in 1103 patients. Diseases of the Colon and Rectum. 2011; 54(9):1076-81

11. Cirocchi R, Cochetti G, Randolph J, Listorti C, Castellani E, Renzi C et al. Laparoscopic treatment of colovesical fistulas due to complicated colonic diverticular disease: a systematic review. Techniques in Coloproctology. 2014; 18(10):873-85

12. Cirocchi R, Trastulli S, Desiderio J, Listorti C, Boselli C, Parisi A et al. Treatment of Hinchey stage III-IV diverticulitis: a systematic review and meta-analysis. International Journal of Colorectal Disease. 2013; 28(4):447-457

13. Classen JN, Bonardi R, O'Mara CS, Finney DC, Sterioff S. Surgical treatment of acute diverticulitis by staged procedures. Annals of Surgery. 1976; 184(5):582-6

14. De Mulder W, Gillardin JP, Hofman P, Van Molhem Y. Laparoscopic colorectal surgery. Analysis of the first 237 cases. Acta Chirurgica Belgica. 2001; 101(1):25-30

15. Dehal A, Patel S, Park H, Nguyen P, Yuhan R, Ruan J. Robotic colorectal surgery: Our initial experience. American Surgeon. 2016; 82(10):907-910

16. Geisler D, Garrett T. Single incision laparoscopic colorectal surgery: a single surgeon experience of 102 consecutive cases. Techniques in Coloproctology. 2011; 15(4):397-401

17. Gervaz P, Pikarsky A, Utech M, Secic M, Efron J, Belin B et al. Converted laparoscopic colorectal surgery: A meta-analysis. Surgical Endoscopy. 2001; 15(8):827-832

18. Hildebrand P, Kropp M, Stellmacher F, Roblick UJ, Bruch HP, Schwandner O. Surgery for right-sided colonic diverticulitis: results of a 10-year-observation period. Langenbecks Archives of Surgery. 2007; 392(2):143-7

19. Juo YY, Agarwal S, Luka S, Satey S, Obias V. Single-Incision Robotic Colectomy (SIRC) case series: initial experience at a single center. Surgical Endoscopy. 2015; 29(7):1976-81

20. Kang CY, Chaudhry OO, Halabi WJ, Nguyen V, Carmichael JC, Stamos MJ et al. Outcomes of laparoscopic colorectal surgery: data from the Nationwide Inpatient Sample 2009 American Journal of Surgery. 2012; 204(6):952-957

21. Keidar S, Pappo I, Shperber Y, Orda R. Cecal diverticulitis: a diagnostic challenge. Digestive Surgery. 2000; 17(5):508-12

22. Klarenbeek BR, Peet DL, Cuesta MA. Laparoscopic sigmoid resection for diverticulitis decreases major morbidity rates: a randomized controlled trial. Annals of Surgery. 2009; 250(3):501-502

23. Lane JS, Sarkar R, Schmit PJ, Chandler CF, Thompson JE, Jr. Surgical approach to cecal diverticulitis. Journal of the American College of Surgeons. 1999; 188(6):629-34; discussion 634-5

24. Laurent SR, Detroz B, Detry O, Degauque C, Honore P, Meurisse M. Laparoscopic sigmoidectomy for fistulized diverticulitis. Diseases of the Colon and Rectum. 2005; 48(1):148-52

25. Lee IK, Lee YS, Kim SJ, Gorden DL, Won DY, Kim HJ et al. Laparoscopic and open surgery for right colonic diverticulitis. American Surgeon. 2010; 76(5):486-91

26. Lezoche E, Feliciotti F, Guerrieri M, Paganini AM, Sanctis A, Campagnacci R et al. Laparoscopic versus open hemicolectomy. Minerva Chirurgica. 2003; 58(4):491-502, 502-7

27. Lo CY, Chu KW. Acute diverticulitis of the right colon. American Journal of Surgery. 1996; 171(2):244-6

28. Luoma A, Nagy AG. Cecal diverticulitis. Canadian Journal of Surgery. 1989; 32(4):283-6

29. Marcello PW, Fleshman JW, Milsom JW, Read TE, Arnell TD, Birnbaum EH et al. Hand-assisted laparoscopic vs. laparoscopic colorectal surgery: A multicenter, prospective, randomized trial. Diseases of the Colon and Rectum. 2008; 51(6):818-826

30. Markham NI, Li AK. Diverticulitis of the right colon--experience from Hong Kong. Gut. 1992; 33(4):547-9

31. Menenakos E, Hahnloser D, Nassiopoulos K, Chanson C, Sinclair V, Petropoulos P. Laparoscopic surgery for fistulas that complicate diverticular disease. Langenbecks Archives of Surgery. 2003; 388(3):189-93

32. Minardi AJ, Jr., Johnson LW, Sehon JK, Zibari GB, McDonald JC. Diverticulitis in the young patient. American Surgeon. 2001; 67(5):458-61

33. Moon HJ, Park JK, Lee JI, Lee JH, Shin HJ, Kim WS et al. Conservative treatment for patients with acute right colonic diverticulitis. American Surgeon. 2007; 73(12):1237-41

34. Morino M, Rimonda R, Allaix ME, Giraudo G, Garrone C. Ultrasonic versus standard electric dissection in laparoscopic colorectal surgery: a prospective randomized clinical trial. Annals of Surgery. 2005; 242(6):897-901, discussion 901

35. National Institute for Health and Care Excellence. Developing NICE guidelines: the manual. London. National Institute for Health and Care Excellence, 2014. Available from: http://www.nice.org.uk/article/PMG20/chapter/1%20Introduction%20and%20overview

36. Neumann L, Gruenagel HH, Model P. Colon diverticulitis conservative and surgical treatment. Die Medizinische Welt. 1991; 42:771-773

37. Nguyen SQ, Divino CM, Vine A, Reiner M, Katz LB, Salky B. Laparoscopic surgery for diverticular disease complicated by fistulae. Journal of the Society of Laparoendoscopic Surgeons. 2006; 10(2):166-8

38. Pattyn P, De Waele J, Cleyman S, Hesse U, de Hemptinne B. Surgical management of diverticulitis. A two year retrospective study. Acta Gastroenterologica Belgica. 1996; 59(2):155-8

39. Piessen G, Muscari F, Rivkine E, Sbai-Idrissi MS, Lorimier G, Fingerhut A et al. Prevalence of and risk factors for morbidity after elective left colectomy: cancer vs noncomplicated diverticular disease. Archives of Surgery. 2011; 146(10):1149-55

40. Raventos JM, Symmonds RE. Surgical management of acute diverticulitis in women. Obstetrics and Gynecology. 1981; 58(5):557-65

41. Renzulli P, Maurer CA, Netzer P, Dinkel HP, Buchler MW. Subtotal colectomy with primary ileorectostomy is effective for unlocalized, diverticular hemorrhage. Langenbecks Archives of Surgery. 2002; 387(2):67-71

42. Ross H, Steele S, Whiteford M, Lee S, Albert M, Mutch M et al. Early multi-institution experience with single-incision laparoscopic colectomy. Diseases of the Colon and Rectum. 2011; 54(2):187-92

43. Schadde E, Smith D, Alkoraishi AS, Begos DG. Hand-assisted laparoscopic colorectal surgery (HALS) at a community hospital: a prospective analysis of 104 consecutive cases. Surgical Endoscopy. 2006; 20(7):1077-82

44. Schmit PJ, Bennion RS, Thompson JE, Jr. Cecal diverticulitis: a continuing diagnostic dilemma. World Journal of Surgery. 1991; 15(3):367-71

45. Schwandner O, Farke S, Fischer F, Eckmann C, Schiedeck TH, Bruch HP. Laparoscopic colectomy for recurrent and complicated diverticulitis: a prospective study of 396 patients. Langenbecks Archives of Surgery. 2004; 389(2):97-103

46. Senagore AJ, Delaney CP. A critical analysis of laparoscopic colectomy at a single institution: lessons learned after 1000 cases. American Journal of Surgery. 2006; 191(3):377-80

47. Senapati A, Marks CG. Management of perforated diverticular disease. Annals of the Royal College of Surgeons of England. 1995; 77(3):161-2

48. Sher, M E, Agachan, Bortul, Nogueras, J J et al. Laparoscopic surgery for diverticulitis. Surgical Endoscopy. 1997; 11:264-267

49. Slim K, Pezet D, Stencl J, Jr., Lagha K, Le Roux S, Lechner C et al. Prospective analysis of 40 initial laparoscopic colorectal resections: a plea for a randomized trial. Journal of Laparoendoscopic Surgery. 1994; 4(4):241-5

50. Somasekar K, Foster ME, Haray PN. The natural history diverticular disease: is there a role for elective colectomy? Journal of the Royal College of Surgeons of Edinburgh. 2002; 47(2):481-2, 484

51. Spasojevic M, Naesgaard JM, Ignjatovic D. Perforated midgut diverticulitis: revisited. World Journal of Gastroenterology. 2012; 18(34):4714-20

52. Thiede A. Treatment of uncomplicated and complicated diverticulitis Prospective study from the surgical point of view. Internistische Praxis. 1992; 32:499-508

53. Vestweber B, Galetin T, Lammerting K, Paul C, Giehl J, Straub E et al. Single-incision laparoscopic surgery: outcomes from 224 colonic resections performed at a single center using SILS. Surgical Endoscopy. 2013; 27(2):434-42

54. Violi V, Roncoroni L, Boselli AS, Trivelli M, Peracchia A. Diverticulitis of the caecum and ascending colon: an unavoidable diagnostic pitfall? International Surgery. 2000; 85(1):39-47

55. Wexner SD, Reissman P, Pfeifer J, Bernstein M, Geron N. Laparoscopic colorectal surgery: analysis of 140 cases. Surgical Endoscopy. 1996; 10(2):133-6

56. Wolff BG, Ready RL, MacCarty RL, Dozois RR, Beart RW, Jr. Influence of sigmoid resection on progression of diverticular disease of the colon. Diseases of the Colon and Rectum. 1984; 27(10):645-7

57. Wyble EJ, Lee WC. Cecal diverticulitis: changing trends in management. Southern Medical Journal. 1988; 81(3):313-6

Appendices

Appendix A: Review protocols

Table 2: Review protocol: Complicated acute diverticulitis - extent of colectomy

Field	Content
Review question	What is the most appropriate extent of colectomy in people with complicated acute diverticulitis?
Type of review question	intervention review A review of health economic evidence related to the same review question was conducted in parallel with this review. For details see the health economic review protocol for this NICE guideline.
Objective of the review	To determine the most appropriate Extent of colectomy in people with complicated acute diverticulitis
Eligibility criteria – population / disease / condition / issue / domain	Adults 18 years and over with acute diverticulitis
Eligibility criteria – intervention(s) / exposure(s) / prognostic factor(s)	Colectomy/bowel resection
Eligibility criteria – comparator(s) / control or reference (gold) standard	Different extents of colectomy as reported by studies

Outcomes and prioritisation	Critical outcomes:
	• Quality of life
	• Mortality
	• Morbidity
	• Progression of disease
	• Complications:
	  ○ infections
	  ○ abscesses
	  ○ perforation
	  ○ fistula
	  ○ stricture
	• Recurrence rates of acute diverticulitis
	• Hospitalisation
	• Need for further surgery
	• Anastomotic leak rate
	
	Important outcomes:
	• Symptom control/recurrence, for example pain relief, bowel habit

Eligibility criteria – study design	Randomised controlled trials (RCTs), systematic reviews of RCTs. If no RCT evidence is available, search for observational studies
Other inclusion exclusion criteria	Exclusions: • Children and young people aged 17 years and younger • Prevention

Proposed sensitivity / subgroup analysis, or meta-regression	Subgroups: • Age: <50 and >50 years • people of Asian family origin as they are known to develop right-sided diverticula
Selection process – duplicate screening / selection / analysis	Studies are sifted by title and abstract. Potentially significant publications obtained in full text are then assessed against the inclusion criteria specified in this protocol.
Data management (software)	• Pairwise meta-analyses performed using Cochrane Review Manager (RevMan5). • GRADEpro used to assess the quality of evidence for each outcome • Bibliographies, citations and study sifting managed using EndNote • Data extractions performed using EviBase, a platform designed and maintained by the National Guideline Centre (NGC)
Information sources – databases and dates	Medline, Embase, The Cochrane Library
Identify if an update	Not applicable
Author contacts	https://www.nice.org.uk/guidance/conditions-and-diseases/digestive-tract-conditions/diverticular-disease
Highlight if amendment to previous protocol	For details please see section 4.5 of Developing NICE guidelines: the manual.
Search strategy – for one database	For details please see appendix B
Data collection process – forms / duplicate	A standardised evidence table format will be used, and published as appendix D of the evidence report.
Data items – define all variables to be collected	For details please see evidence tables in Appendix D (clinical evidence tables) or G (health economic evidence tables).
Methods for assessing bias at outcome / study level	Standard study checklists were used to critically appraise individual studies. For details please see section 6.2 of Developing NICE guidelines: the manual The risk of bias across all available evidence was evaluated for each outcome using an adaptation of the 'Grading of Recommendations Assessment, Development and Evaluation (GRADE) toolbox' developed by the international GRADE working group http://www.gradeworkinggroup.org/
Criteria for quantitative synthesis	For details please see section 6.4 of Developing NICE guidelines: the manual.
Methods for quantitative analysis – combining studies and exploring (in)consistency	For details please see the separate Methods report (Chapter R) for this guideline.
Meta-bias assessment – publication bias, selective reporting bias	For details please see section 6.2 of Developing NICE guidelines: the manual.
Confidence in cumulative evidence	For details please see sections 6.4 and 9.1 of Developing NICE guidelines: the manual.
Rationale / context – what is known	For details please see the introduction to the evidence review.
Describe contributions of authors and guarantor	A multidisciplinary committee developed the evidence review. The committee was convened by the National Guideline Centre (NGC) and chaired by James Dalrymple in line with section 3 of Developing NICE guidelines: the manual.

	Staff from NGC undertook systematic literature searches, appraised the evidence, conducted meta-analysis and cost-effectiveness analysis where appropriate, and drafted the evidence review in collaboration with the committee. For details please see Developing NICE guidelines: the manual.
Sources of funding / support	NGC is funded by NICE and hosted by the Royal College of Physicians.
Name of sponsor	NGC is funded by NICE and hosted by the Royal College of Physicians.
Roles of sponsor	NICE funds NGC to develop guidelines for those working in the NHS, public health and social care in England.
PROSPERO registration number	Not registered

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2 **Table 3: Health economic review protocol**

Review question	All questions – health economic evidence
Objectives	To identify health economic studies relevant to any of the review questions.
Search criteria	• Populations, interventions and comparators must be as specified in the clinical review protocol above. • Studies must be of a relevant health economic study design (cost–utility analysis, cost-effectiveness analysis, cost–benefit analysis, cost–consequences analysis, comparative cost analysis). • Studies must not be a letter, editorial or commentary, or a review of health economic evaluations. (Recent reviews will be ordered although not reviewed. The bibliographies will be checked for relevant studies, which will then be ordered.) • Unpublished reports will not be considered unless submitted as part of a call for evidence. • Studies must be in English.
Search strategy	A health economic study search will be undertaken using population-specific terms and a health economic study filter – see appendix B below.
Review strategy	Studies not meeting any of the search criteria above will be excluded. Studies published before 2002, abstract-only studies and studies from non-OECD countries or the USA will also be excluded. Each remaining study will be assessed for applicability and methodological limitations using the NICE economic evaluation checklist which can be found in appendix H of Developing NICE guidelines: the manual (2014).[35] **Inclusion and exclusion criteria** • If a study is rated as both 'Directly applicable' and with 'Minor limitations' then it will be included in the guideline. A health economic evidence table will be completed and it will be included in the health economic evidence profile. • If a study is rated as either 'Not applicable' or with 'Very serious limitations' then it will usually be excluded from the guideline. If it is excluded then a health economic evidence table will not be completed and it will not be included in the health economic evidence profile. • If a study is rated as 'Partially applicable', with 'Potentially serious limitations' or both then there is discretion over whether it should be included. **Where there is discretion** The health economist will make a decision based on the relative applicability and quality of the available evidence for that question, in discussion with the guideline committee if required. The ultimate aim is to include health economic studies that are

	helpful for decision-making in the context of the guideline and the current NHS setting. If several studies are considered of sufficiently high applicability and methodological quality that they could all be included, then the health economist, in discussion with the committee if required, may decide to include only the most applicable studies and to selectively exclude the remaining studies. All studies excluded on the basis of applicability or methodological limitations will be listed with explanation in the excluded health economic studies appendix below. The health economist will be guided by the following hierarchies. *Setting:* • UK NHS (most applicable). • OECD countries with predominantly public health insurance systems (for example, France, Germany, Sweden). • OECD countries with predominantly private health insurance systems (for example, Switzerland). • Studies set in non-OECD countries or in the USA will be excluded before being assessed for applicability and methodological limitations. *Health economic study type:* • Cost–utility analysis (most applicable). • Other type of full economic evaluation (cost–benefit analysis, cost-effectiveness analysis, cost–consequences analysis). • Comparative cost analysis. • Non-comparative cost analyses including cost-of-illness studies will be excluded before being assessed for applicability and methodological limitations. *Year of analysis:* • The more recent the study, the more applicable it will be. • Studies published in 2002 or later but that depend on unit costs and resource data entirely or predominantly from before 2002 will be rated as 'Not applicable'. • Studies published before 2002 will be excluded before being assessed for applicability and methodological limitations. *Quality and relevance of effectiveness data used in the health economic analysis:* • The more closely the clinical effectiveness data used in the health economic analysis match with the outcomes of the studies included in the clinical review the more useful the analysis will be for decision-making in the guideline.

Appendix B: Literature search strategies

The literature searches for this review are detailed below and complied with the methodology outlined in Developing NICE guidelines: the manual 2014, updated 2017

For more detailed information, please see the Methodology Review.

Clinical search literature search strategy

Searches were constructed using a PICO framework where population (P) terms were combined with Intervention (I) and in some cases Comparison (C) terms. Outcomes (O) are rarely used in search strategies for interventions as these concepts may not be well described in title, abstract or indexes and therefore difficult to retrieve. Search filters were applied to the search where appropriate.

Table 4: Database date parameters and filters used

Database	Dates searched	Search filter used
Medline (OVID)	1946 – 13 November 2018	Exclusions

Database	Dates searched	Search filter used
		Randomised controlled trials Systematic review studies Observational studies
Embase (OVID)	1974 – 13 November 2018	Exclusions Randomised controlled trials Systematic review studies Observational studies
The Cochrane Library (Wiley)	Cochrane Reviews to 2018 Issue 11 of 12 CENTRAL to 2018 Issue 11 of 12 DARE, and NHSEED to 2015 Issue 2 of 4 HTA to 2016 Issue 2 of 4	None

1 **Table 5: Medline (Ovid) search terms**

1.	diverticul*.mp.
2.	limit 1 to English language
3.	letter/
4.	editorial/
5.	news/
6.	exp historical article/
7.	Anecdotes as Topic/
8.	comment/
9.	case report/
10.	(letter or comment*).ti.
11.	or/3-10
12.	randomized controlled trial/ or random*.ti,ab.
13.	11 not 12
14.	animals/ not humans/
15.	exp Animals, Laboratory/
16.	exp Animal Experimentation/
17.	exp Models, Animal/
18.	exp Rodentia/
19.	(rat or rats or mouse or mice).ti.
20.	or/13-19
21.	2 not 20
22.	randomized controlled trial.pt.
23.	controlled clinical trial.pt.
24.	randomi#ed.ti,ab.
25.	placebo.ab.
26.	randomly.ti,ab.
27.	Clinical Trials as topic.sh.
28.	trial.ti.
29.	or/22-28
30.	Meta-Analysis/

31.	exp Meta-Analysis as Topic/
32.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
33.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
34.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
35.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
36.	(search* adj4 literature).ab.
37.	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
38.	cochrane.jw.
39.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
40.	or/50-59
41.	Epidemiologic studies/
42.	Observational study/
43.	exp Cohort studies/
44.	(cohort adj (study or studies or analys* or data)).ti,ab.
45.	((follow up or observational or uncontrolled or non randomi#ed or epidemiologic*) adj (study or studies or data)).ti,ab.
46.	((longitudinal or retrospective or prospective or cross sectional) and (study or studies or review or analys* or cohort* or data)).ti,ab.
47.	Controlled Before-After Studies/
48.	Historically Controlled Study/
49.	Interrupted Time Series Analysis/
50.	(before adj2 after adj2 (study or studies or data)).ti,ab.
51.	or/30-39
52.	exp case control study/
53.	case control*.ti,ab.
54.	or/41-42
55.	40 or 43
56.	Cross-sectional studies/
57.	(cross sectional and (study or studies or review or analys* or cohort* or data)).ti,ab.
58.	or/45-46
59.	40 or 47
60.	40 or 43 or 47
61.	21 and (29 or 40 or 60)

1 **Table 6: Embase (Ovid) search terms**

1.	diverticul*.mp.
2.	limit 1 to English language
3.	letter.pt. or letter/
4.	note.pt.
5.	editorial.pt.
6.	case report/ or case study/
7.	(letter or comment*).ti.
8.	or/3-7
9.	randomized controlled trial/ or random*.ti,ab.
10.	8 not 9

11.	animal/ not human/
12.	nonhuman/
13.	exp Animal Experiment/
14.	exp Experimental Animal/
15.	animal model/
16.	exp Rodent/
17.	(rat or rats or mouse or mice).ti.
18.	or/10-17
19.	2 not 18
20.	random*.ti,ab.
21.	factorial*.ti,ab.
22.	(crossover* or cross over*).ti,ab.
23.	((doubl* or singl*) adj blind*).ti,ab.
24.	(assign* or allocat* or volunteer* or placebo*).ti,ab.
25.	crossover procedure/
26.	single blind procedure/
27.	randomized controlled trial/
28.	double blind procedure/
29.	or/20-28
30.	systematic review/
31.	meta-analysis/
32.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
33.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
34.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
35.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
36.	(search* adj4 literature).ab.
37.	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
38.	cochrane.jw.
39.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
40.	or/30-39
41.	Clinical study/
42.	Observational study/
43.	family study/
44.	longitudinal study/
45.	retrospective study/
46.	prospective study/
47.	cohort analysis/
48.	follow-up/
49.	cohort*.ti,ab.
50.	48 and 49
51.	(cohort adj (study or studies or analys* or data)).ti,ab.
52.	((follow up or observational or uncontrolled or non randomi#ed or epidemiologic*) adj (study or studies or data)).ti,ab.

53.	((longitudinal or retrospective or prospective or cross sectional) and (study or studies or review or analys* or cohort* or data)).ti,ab.
54.	(before adj2 after adj2 (study or studies or data)).ti,ab.
55.	or/41-47,50-54
56.	exp case control study/
57.	case control*.ti,ab.
58.	or/56-57
59.	55 or 58
60.	cross-sectional study/
61.	(cross sectional and (study or studies or review or analys* or cohort* or data)).ti,ab.
62.	or/60-61
63.	55 or 62
64.	55 or 58 or 62
65.	19 and (29 or 40 or 64)

Table 7: Cochrane Library (Wiley) search terms

#1.	diverticul*.mp.

B.1 Health Economics literature search strategy

Health economic evidence was identified by conducting a broad search relating to Diverticular Disease population in NHS Economic Evaluation Database (NHS EED – this ceased to be updated after March 2015) and the Health Technology Assessment database (HTA) with no date restrictions. NHS EED and HTA databases are hosted by the Centre for Research and Dissemination (CRD). Additional searches were run on Medline and Embase for health economics, economic modelling and quality of life studies.

Table 8: Database date parameters and filters used

Database	Dates searched	Search filter used
Medline	1946 – 13 November 2018	Exclusions Health economics studies Health economics modelling studies Quality of life studies
Embase	1974 – 13 November 2018	Exclusions Health economics studies Health economics modelling studies Quality of life studies
Centre for Research and Dissemination (CRD)	HTA - Inception – 13 November 2018 NHSEED - Inception to March 2015	None

Table 9: Medline (Ovid) search terms

1.	diverticul*.mp.
2.	limit 1 to English language

3.	letter/
4.	editorial/
5.	news/
6.	exp historical article/
7.	Anecdotes as Topic/
8.	comment/
9.	case report/
10.	(letter or comment*).ti.
11.	or/3-10
12.	randomized controlled trial/ or random*.ti,ab.
13.	11 not 12
14.	animals/ not humans/
15.	exp Animals, Laboratory/
16.	exp Animal Experimentation/
17.	exp Models, Animal/
18.	exp Rodentia/
19.	(rat or rats or mouse or mice).ti.
20.	or/13-19
21.	2 not 20
22.	Economics/
23.	Value of life/
24.	exp "Costs and Cost Analysis"/
25.	exp Economics, Hospital/
26.	exp Economics, Medical/
27.	Economics, Nursing/
28.	Economics, Pharmaceutical/
29.	exp "Fees and Charges"/
30.	exp Budgets/
31.	budget*.ti,ab.
32.	cost*.ti.
33.	(economic* or pharmaco?economic*).ti.
34.	(price* or pricing*).ti,ab.
35.	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
36.	(financ* or fee or fees).ti,ab.
37.	(value adj2 (money or monetary)).ti,ab.
38.	or/22-37
39.	exp models, economic/
40.	*Models, Theoretical/
41.	markov chains/
42.	monte carlo method/
43.	exp Decision Theory/
44.	(markov* or monte carlo).ti,ab.
45.	econom* model*.ti,ab.

46.	(decision* adj2 (tree* or analy* or model*)).ti,ab.
47.	Models, Organizational/
48.	*models, statistical/
49.	*logistic models/
50.	models, nursing/
51.	((organi?ation* or operation* or service* or concept*) adj3 (model* or map* or program* or simulation* or system* or analys*)).ti,ab.
52.	(econom* adj2 (theor* or system* or map* or evaluat*)).ti,ab.
53.	(SSM or SODA).ti,ab.
54.	(strateg* adj3 (option* or choice*) adj3 (analys* or decision*)).ti,ab.
55.	soft systems method*.ti,ab.
56.	(Meta-heuristic* or Metaheuristic*).ti,ab.
57.	(dynamic* adj2 (model* or system*)).ti,ab.
58.	(simulation adj3 (model* or discrete event* or agent)).ti,ab.
59.	(microsimulation* or "micro* simulation*").ti,ab.
60.	((flow or core) adj2 model*).ti,ab.
61.	(data adj2 envelopment*).ti,ab.
62.	system* model*.ti,ab.
63.	or/41-64
64.	quality-adjusted life years/
65.	sickness impact profile/
66.	(quality adj2 (wellbeing or well being)).ti,ab.
67.	sickness impact profile.ti,ab.
68.	disability adjusted life.ti,ab.
69.	(qal* or qtime* or qwb* or daly*).ti,ab.
70.	(euroqol* or eq5d* or eq 5*).ti,ab.
71.	(qol* or hql* or hqol* or h qol* or hrqol* or hr qol*).ti,ab.
72.	(health utility* or utility score* or disutilit* or utility value*).ti,ab.
73.	(hui or hui1 or hui2 or hui3).ti,ab.
74.	(health* year* equivalent* or hye or hyes).ti,ab.
75.	discrete choice*.ti,ab.
76.	rosser.ti,ab.
77.	(willingness to pay or time tradeoff or time trade off or tto or standard gamble*).ti,ab.
78.	(sf36* or sf 36* or short form 36* or shortform 36* or shortform36*).ti,ab.
79.	(sf20 or sf 20 or short form 20 or shortform 20 or shortform20).ti,ab.
80.	(sf12* or sf 12* or short form 12* or shortform 12* or shortform12*).ti,ab.
81.	(sf8* or sf 8* or short form 8* or shortform 8* or shortform8*).ti,ab.
82.	(sf6* or sf 6* or short form 6* or shortform 6* or shortform6*).ti,ab.
83.	or/22-40
84.	21 and (38 or 63 or 83)

Table 10: Embase (Ovid) search terms

1.	diverticul*.mp.
2.	limit 1 to English language
3.	letter.pt. or letter/

4.	note.pt.
5.	editorial.pt.
6.	case report/ or case study/
7.	(letter or comment*).ti.
8.	or/3-7
9.	randomized controlled trial/ or random*.ti,ab.
10.	8 not 9
11.	animal/ not human/
12.	nonhuman/
13.	exp Animal Experiment/
14.	exp Experimental Animal/
15.	animal model/
16.	exp Rodent/
17.	(rat or rats or mouse or mice).ti.
18.	or/10-17
19.	2 not 18
20.	Economics/
21.	Value of life/
22.	exp "Costs and Cost Analysis"/
23.	exp Economics, Hospital/
24.	exp Economics, Medical/
25.	Economics, Nursing/
26.	Economics, Pharmaceutical/
27.	exp "Fees and Charges"/
28.	exp Budgets/
29.	budget*.ti,ab.
30.	cost*.ti.
31.	(economic* or pharmaco?economic*).ti.
32.	(price* or pricing*).ti,ab.
33.	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
34.	(financ* or fee or fees).ti,ab.
35.	(value adj2 (money or monetary)).ti,ab.
36.	or/20-35
37.	statistical model/
38.	*theoretical model/
39.	nonbiological model/
40.	stochastic model/
41.	decision theory/
42.	decision tree/
43.	exp nursing theory/

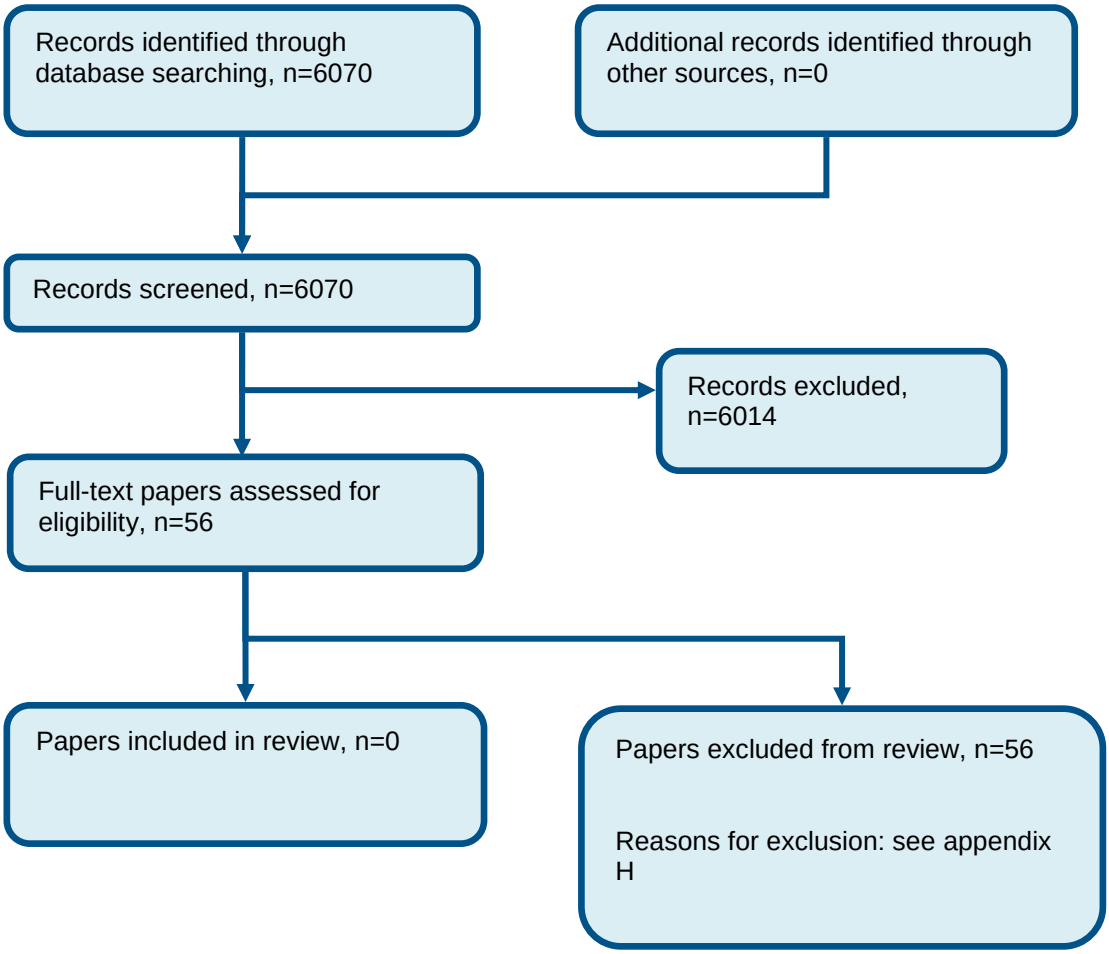
44.	monte carlo method/
45.	(markov* or monte carlo).ti,ab.
46.	econom* model*.ti,ab.
47.	(decision* adj2 (tree* or analy* or model*)).ti,ab.
48.	((organi?ation* or operation* or service* or concept*) adj3 (model* or map* or program* or simulation* or system* or analys*)).ti,ab.
49.	(econom* adj2 (theor* or system* or map* or evaluat*)).ti,ab.
50.	(SSM or SODA).ti,ab.
51.	(strateg* adj3 (option* or choice*) adj3 (analys* or decision*)).ti,ab.
52.	soft systems method*.ti,ab.
53.	(Meta-heuristic* or Metaheuristic*).ti,ab.
54.	(dynamic* adj2 (model* or system*)).ti,ab.
55.	(simulation adj3 (model* or discrete event* or agent)).ti,ab.
56.	(microsimulation* or "micro* simulation*").ti,ab.
57.	((flow or core) adj2 model*).ti,ab.
58.	(data adj2 envelopment*).ti,ab.
59.	system* model*.ti,ab.
60.	or/39-61
61.	quality adjusted life year/
62.	"quality of life index"/
63.	short form 12/ or short form 20/ or short form 36/ or short form 8/
64.	sickness impact profile/
65.	(quality adj2 (wellbeing or well being)).ti,ab.
66.	sickness impact profile.ti,ab.
67.	disability adjusted life.ti,ab.
68.	(qal* or qtime* or qwb* or daly*).ti,ab.
69.	(euroqol* or eq5d* or eq 5*).ti,ab.
70.	(qol* or hql* or hqol* or h qol* or hrqol* or hr qol*).ti,ab.
71.	(health utility* or utility score* or disutilit* or utility value*).ti,ab.
72.	(hui or hui1 or hui2 or hui3).ti,ab.
73.	(health* year* equivalent* or hye or hyes).ti,ab.
74.	discrete choice*.ti,ab.
75.	rosser.ti,ab.
76.	(willingness to pay or time tradeoff or time trade off or tto or standard gamble*).ti,ab.
77.	(sf36* or sf 36* or short form 36* or shortform 36* or shortform36*).ti,ab.
78.	(sf20 or sf 20 or short form 20 or shortform 20 or shortform20).ti,ab.
79.	(sf12* or sf 12* or short form 12* or shortform 12* or shortform12*).ti,ab.
80.	(sf8* or sf 8* or short form 8* or shortform 8* or shortform8*).ti,ab.
81.	(sf6* or sf 6* or short form 6* or shortform 6* or shortform6*).ti,ab.
82.	or/20-40
83.	19 and (36 or 60 or 82)

Table 11: NHS EED and HTA (CRD) search terms

#1.	diverticul*

Appendix C: Clinical evidence selection

Figure 1: Flow chart of clinical study selection for the review of complicated acute diverticulitis - extent of colectomy



Appendix D: Clinical evidence tables

No evidence was identified.

Appendix E: Forest plots

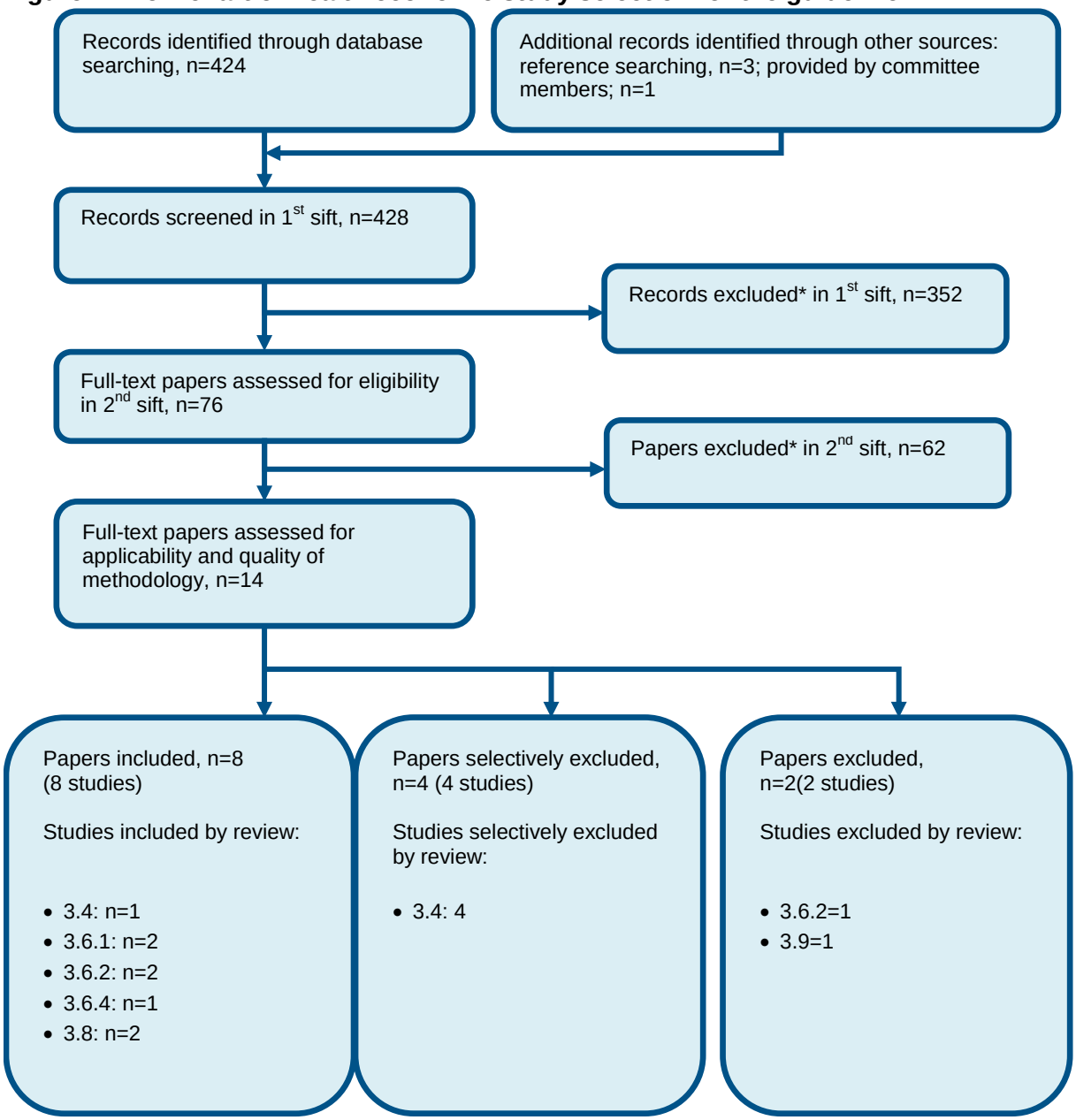
No evidence was identified.

Appendix F: GRADE tables

No evidence was identified.

Appendix G: Health economic evidence selection

Figure 2: Flow chart of health economic study selection for the guideline



* Non-relevant population, intervention, comparison, design or setting; non-English language

3.4 Non-surgical treatment of acute diverticulitis (Evidence review H)

3.6.1 Timing of surgery (Evidence review J)

3.6.2 Laparoscopic versus open resection (Evidence review K)

3.6.4 Primary versus secondary anastomosis (Evidence review M)

3.8 Laparoscopic lavage versus resection for perforated diverticulitis (Evidence review O)

3.9 Management of recurrent diverticulitis (Evidence review P)

Appendix H: Excluded studies

H.1 Excluded clinical studies

Table 12: Studies excluded from the clinical review

Study	Exclusion reason
Abbass 2013[1]	Inappropriate comparison. Incorrect interventions
Abedi 2004[2]	Incorrect study design
Ambrosetti 2007[3]	Not review population
Blitzer 2014[4]	Not review population
Boermeester 2016[5]	Incorrect interventions
Botsford 1971[6]	Not review population. Incorrect study design
Boulez 1997[7]	Not review population. Incorrect study design
Carpenter 1972[8]	Incorrect study design
Chiu 2001[9]	Not review population. Inappropriate comparison
Cima 2011[10]	Not review population
Cirocchi 2013[12]	Inappropriate comparison. Incorrect interventions
Cirocchi 2014[11]	Incorrect interventions
Classen 1976[13]	Incorrect interventions
De mulder 2001[14]	Not review population
Dehal 2016[15]	Not review population. Inappropriate comparison
Geisler 2011[16]	Not review population
Gervaz 2001[17]	Not review population. Inappropriate comparison. Incorrect interventions
Hildebrand 2007[18]	Incorrect study design
Juo 2015[19]	Not review population. Inappropriate comparison. Incorrect interventions. Incorrect study design
Kang 2012[20]	Not review population. Incorrect interventions
Keidar 2000[21]	Incorrect study design
Klarenbeek 2009[22]	Incorrect study design
Lane 1999[23]	Not review population
Laurent 2005[24]	Incorrect study design
Lee 2010[25]	Not review population
Lezoche 2003[26]	Not review population. Incorrect interventions
Lo 1996[27]	Incorrect study design
Luoma 1989[28]	Incorrect study design
Marcello 2008[29]	Not review population
Markham 1992[30]	Not review population. Inappropriate comparison
Menenakos 2003[31]	Incorrect study design
Minardi 2001[32]	Not review population. Inappropriate comparison
Moon 2007[33]	Incorrect interventions
Morino 2005[34]	Not review population. Incorrect interventions
Neumann 1991[36]	Not in English
Nguyen 2006[37]	Incorrect study design
Pattyn 1996[38]	Incorrect study design
Piessen 2011[39]	Not review population

Study	Exclusion reason
Raventos 1981[40]	Not review population. Incorrect interventions
Renzulli 2002[41]	Not review population
Ross 2011[42]	Not review population. Incorrect interventions
Schadde 2006[43]	Not review population. Inappropriate comparison
Schmit 1991[44]	Not review population. Incorrect study design
Schwandner 2004[45]	Not review population
Senagore 2006[46]	Not review population
Senapati 1995[47]	Incorrect study design
Sher 1997[48]	Incorrect interventions
Slim 1994[49]	Not review population. Inappropriate comparison. Incorrect interventions
Somasekar 2002[50]	Inappropriate comparison. Incorrect interventions
Spasojevic 2012[51]	Not review population
Thiede 1992[52]	Not in English
Vestweber 2013[53]	Not review population
Violi 2000[54]	Incorrect study design
Wexner 1996[55]	Not review population
Wolff 1984[56]	Incorrect study design
Wyble 1988[57]	Incorrect study design

1

2