National Institute for Health and Care Excellence

Consultation

Diverticular disease

N. Evidence review: Percutaneous drainage versus resectional surgery for the management of abscesses

NICE guideline

Intervention evidence review

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Draft for Consultation

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1

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Contents

1

1 Management of acute diverticulitis

1.1 Review question: What is the clinical and cost effectiveness of percutaneous drainage versus resectional surgery for the management of abscesses?

1.2 Introduction

Diverticular abscess represents a particular therapeutic challenge given the predominant age and frequent co-morbidities of patients presenting with the condition. There has been much interest in the use of minimally invasive techniques such as percutaneous drainage to minimise the morbidity and mortality that is associated with resectional surgery. However, no clear guidance is currently available to suggest which patients should undergo percutaneous drainage versus surgery or for the subsequent management of patients initially treated conservatively. This review of the evidence aimed to provide information for both clinicians and patient to determine the clinical and cost effectiveness of percutaneous drainage versus resectional surgery for the management of diverticular abscess.

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 diverticular abscesses
Interventions	Percutaneous drainage Antibiotics Surgery Combinations of treatments
Comparisons	Compared to each other
Outcomes	Critical outcomes: • Quality of life • Mortality • Morbidity • Progression of disease • Recurrence of abscess • Complications (infections, abscesses, perforation, fistula, stricture, haemorrhage) • Re-hospitalisation • Need for further surgery/percutaneous drain • Anastomotic leak rate • Stoma
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

In the absence of any relevant randomised controlled trials, six observational studies were included in the review;[3, 6, 9, 13, 25, 26] these are summarised in Table 2 below. The included studies provide outcome data for comparisons among antibiotics, percutaneous drainage and surgery, or combinations of these interventions, used in the treatment of diverticular abscesses. Evidence from these studies is summarised in the clinical evidence summary below (Table 3).

See also the study selection flow chart in appendix C, study evidence tables in appendix D, forest plots in appendix E and GRADE tables in appendix F.

1.4.2 Excluded studies

See the excluded studies list in appendix H.

1.4.3 Summary of clinical studies included in the evidence review

Table 2: Summary of studies included in the evidence review

Study	Intervention and comparison	Population	Outcomes	Patient selection for intervention	Comments
Buchwald 2017[3] Non-randomised study n=107 Retrospective Univariate analysis	**Antibiotics:** No details given concerning dose, type or duration. **Percutaneous drainage + antibiotics:** No details given concerning dose, type or duration of antibiotic treatment. No further details about percutaneous drainage. **Surgery:** Procedures included laparotomy and drainage, sigmoid resection with primary anastomosis and Hartmann's procedure.	Adults 18 years and over with diverticular abscesses (Hinchey stages I and II). Diagnosis in all patients by CT. Clinical findings, blood tests, endoscopic and/or surgical finding and radiology also used for diagnosis.	Re-hospitalisation (readmission due to diverticulitis)	Treatment at discretion of surgeon. Mean age: Antibiotics, 60.5±17.6 years Percutaneous drainage + antibiotics, 71.5±13.6 years Surgery, 65.5±13.4 years Mean abscess size differed between groups: Antibiotics, 3.1±1.8 cm Percutaneous drainage + antibiotics, 5.6±2.4 cm Surgery, 4.6±1.6 cm Localisation of abscesses differed between groups (proportion of pericolic, mesocolic and pelvic abscesses): Antibiotics: 47%, 23% and 30% Percutaneous drainage + antibiotics: 23%, 18% and 59%	

Study	Intervention and comparison	Population	Outcomes	Patient selection for intervention	Comments
				Surgery: 40%, 29% and 31% 'No differences in immunosuppression' - no details for other comorbidities between groups.	
Elagili 2015[6] Non-randomised study n=164 Retrospective Univariate analysis	**Percutaneous drainage + antibiotics + surgery:** Percutaneous drainage performed with wide-spectrum IV antibiotics progressively switched to oral formulation at surgeon discretion. Total treatment course of 1-3 weeks. Followed by emergency or elective surgery. **Antibiotics + surgery:** Wide-spectrum IV antibiotics progressively switched to oral formulation at surgeon discretion. Total treatment course of 1-3 weeks. Followed by emergency or elective surgery.	Adults 18 years and over with an abscess >3 cm associated with sigmoid diverticulitis. Diagnosis by CT.	Mortality Overall morbidity Overall stoma rate	Treatment at discretion of surgeon. Median age: 56.5 (25-85) years vs. 55.5 (36-82) years Median abscess size differed between groups: 4 (3-18.5) cm Vs. 6.7 (3-15) cm Higher proportion of ASA 3 and lower proportion of ASA 2 in percutaneous drainage + antibiotics + surgery group. Charlson comorbidity index similar between groups: 2.1 vs. 2.2	

Study	Intervention and comparison	Population	Outcomes	Patient selection for intervention	Comments
Gregersen 2016[9] Non-randomised study n=3148 Retrospective Univariate analysis	**Antibiotics:** Details of antibiotic treatment could not be obtained from the registers used. This group may consist of those that received antibiotics or no treatment at all. **Percutaneous drainage:** Non-surgical abscess drainage with a transabdominal, transvaginal or transrectal approach. **Surgery:** Includes those that underwent colonic surgery or surgical abscess drainage during admission.	Adults 18 years and over admitted for Hinchey Ib-II diverticulitis (complicated by abscess). Method of diagnosis not specified.	Mortality within 30 days of admission Mortality within 30 days of discharge Re-hospitalisation (readmission due to diverticulitis) Re-hospitalisation (readmission, reasons other than diverticulitis)	Retrospective review of patient records – treatment selected by clinician Mean age: Antibiotics: 65.6±15.4 years Percutaneous drainage: 63.5±14.9 years Surgery: 63.7±15.0 years Details of abscess size in each group not available. Previous episodes of complicated diverticulitis: Antibiotics: 11.4% Percutaneous drainage: 3.5% Surgery: 0% Proportion of patients with comorbidity similar between groups (47%, 50.2% and 54.9%).	
Kaiser 2005[13] Non-randomised study n=511	**Percutaneous drainage + antibiotics:** All patients started on broad-spectrum antibiotics with coverage for gram-negative and anaerobic bacteria. Percutaneous drainage	Adults 18 years and over with diverticulitis complicated by abscess (modified Hinchey stages Ib and II). Diagnosis confirmed	Re-hospitalisation (readmission due to diverticulitis) Need for further surgery/percutaneous drain Stoma creation	Assignment of patients to groups was dependent on whether each abscess was considered to be suitable for percutaneous drainage in terms of size and location.	Data extracted only for abscess subgroup within a larger cohort that this study covers.

Study	Intervention and comparison	Population	Outcomes	Patient selection for intervention	Comments
Retrospective Univariate analysis	performed where abscess was a sufficient size and in favourable location for drainage. **Antibiotics:** All patients started on broad-spectrum antibiotics with coverage for gram-negative and anaerobic bacteria.	by CT scan.		Age not reported separately for each intervention. Mean abscess size: 7.1±1.9 cm vs. 3.6±2.3 cm Lower proportion of stage Ib and higher proportion of stage II abscesses in the percutaneous drainage + antibiotics group. No details concerning comorbidity in each group.	
Siewert 2006[25] Non-randomised study n=181 Retrospective Univariate analysis	**Percutaneous drainage + antibiotics:** CT-guided percutaneous drainage performed within 24 h of admission. No details concerning type, dose or duration of antibiotic treatment. **Antibiotics:** No details concerning type, dose or duration of antibiotic treatment.	Adults 18 years and over with diverticulitis complicated by abscess. Diagnosis confirmed by CT scan.	Need for further surgery/percutaneous drain	Assignment of patients to group was based on patient condition – all of those in the antibiotic group had abscesses where percutaneous drainage was considered to be unfeasible as they could not be reached percutaneously without traversing vital structures. Age not reported separately for each intervention. Mean abscess size: 5.9 cm vs. 3.8 cm.	This study contained results for small and large (<3 cm and ≥3 cm) abscesses, but data was extracted for the large subgroup only, as all of the small abscesses were treated by the same intervention.

Study	Intervention and comparison	Population	Outcomes	Patient selection for intervention	Comments
				No details concerning comorbidity in each group.	
Subhas 2014[26] Non-randomised study n=117 Retrospective Univariate analysis	**Percutaneous drainage + antibiotics:** Treatment with parenteral antibiotics against Gram-negative and anaerobic bacteria while in hospital. Abscesses sent for culture and sensitivity to guide choice of antibiotics. Drainage included simple aspiration to the placement of drains. Includes those that underwent one or more drainages. **Antibiotics:** Treatment with parenteral antibiotics against Gram-negative and anaerobic bacteria while in hospital. Abscesses sent for culture and sensitivity to guide choice of antibiotics.	Adults 18 years and over with CT scan-proven left-sided diverticular abscess treated as inpatients Diagnosis confirmed by CT scan.	Need for further surgery/percutaneous drain Stoma creation	Assignment of patients to group was based on patient condition – those in the antibiotics group were those with abscesses <2 cm or abscesses that were considered to be unsafe for percutaneous drainage. Mean age: 61 (26-91) years vs. 62 (25-92) years. Mean maximum size of abscess cavity: 6 (2-19.1) cm vs. 3 (0.7-8) cm. No details concerning comorbidity in each group.	This study reported outcomes separately for patients that received various numbers of drainages (0, 1, 2 or ≥3) – data for 1, 2 and ≥3 drainages were combined and compared with those that did not receive percutaneous drainage at all.

See appendix D for full evidence tables.

1.4.4 Quality assessment of clinical studies included in the evidence review

Table 3: Clinical evidence summary: Antibiotics vs. surgery

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with surgery	Risk difference with Antibiotics (95% CI)
Re-hospitalisation (readmission due to diverticulitis)	2743 (2 studies) 1-110 months	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	RR 3.11 (1.49 to 6.49)	Moderate	
				35 per 1000	74 more per 1000 (from 17 more to 192 more)
Mortality within 30 days of admission	2658 (1 study) 30 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, imprecision	RR 1.75 (1.02 to 3.01)	Moderate	
				58 per 1000	44 more per 1000 (from 1 more to 117 more)
Mortality within 30 days of discharge	2377 (1 study) 30 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, imprecision	RR 0.56 (0.27 to 1.16)	Moderate	
				40 per 1000	18 fewer per 1000 (from 29 fewer to 6 more)
Re-hospitalisation (readmission, reasons other than diverticulitis)	2658 (1 study) 30 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, imprecision	RR 0.68 (0.53 to 0.87)	Moderate	
				243 per 1000	78 fewer per 1000 (from 32 fewer to 114 fewer)

[a]Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[b]Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 4: Clinical evidence summary: Percutaneous drainage + antibiotics vs. antibiotics

Outcomes	No of	Quality of the evidence	Relative	Anticipated absolute effects

	Participants (studies) Follow up	(GRADE)	effect (95% CI)	Risk with antibiotics	Risk difference with Percutaneous drainage + antibiotics (95% CI)
Re-hospitalisation (readmission due to diverticulitis)	137 (2 studies) 46-110 months	⨁⊖⊖⊖ VERY LOW[a,b,c] due to risk of bias, inconsistency, imprecision	RR 1.56 (0.51 to 4.75)	Moderate	
				226 per 1000	127 more per 1000 (from 111 fewer to 848 more)
Need for further surgery/percutaneous drain	224 (3 studies) unclear	⨁⊖⊖⊖ VERY LOW[a,c] due to risk of bias, imprecision	OR 1.6 (0.85 to 3.01)	Moderate	
				613 per 1000	104 more per 1000 (from 39 fewer to 214 more)
Stoma creation	216 (2 studies) unclear	⨁⊖⊖⊖ VERY LOW[a,c] due to risk of bias, imprecision	RR 1.76 (0.99 to 3.14)	Moderate	
				136 per 1000	103 more per 1000 (from 1 fewer to 291 more)

[a]Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[b]Downgraded by 1 increment because the point estimate varies widely between studies and I2=70%. Subgroup analysis could not be performed to explain heterogeneity due to there only being two studies, but the mean age in the two studies differed (≥50 years and <50 years).
[c]Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 5: Clinical evidence summary: Percutaneous drainage + antibiotics vs. surgery

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with surgery	Risk difference with Percutaneous drainage + antibiotics (95% CI)
Re-hospitalisation (readmission due to diverticulitis)	64 (1 study) 110 months	⨁⊖⊖⊖ VERY LOW[a] due to risk of bias	RR 5.73 (1.26 to 26.05)	Moderate	
				48 per 1000	227 more per 1000 (from 12 more to 1000 more)

[a]Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias

Table 6: Clinical evidence summary: Percutaneous drainage + antibiotics + surgery vs. antibiotics + surgery

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with antibiotics + surgery	Risk difference with Percutaneous drainage + antibiotics + surgery (95% CI)
Mortality	146 (1 study) unclear	⨁⊖⊖⊖ VERY LOW[a,b] due to risk of bias, imprecision	OR 3.66 (0.23 to 57.57)	Moderate	
				0 per 1000	30 more per 1000 (from 30 fewer to 80 more)[c]
Overall morbidity	146 (1 study) unclear	⨁⊖⊖⊖ VERY LOW[a,b] due to risk of bias, imprecision	RR 1.07 (0.63 to 1.83)	Moderate	
				344 per 1000	24 more per 1000 (from 127 fewer to 286 more)
Overall stoma rate	146 (1 study) unclear	⨁⊖⊖⊖ VERY LOW[a,b] due to risk of bias, imprecision	RR 1.3 (0.77 to 2.19)	Moderate	
				344 per 1000	103 more per 1000 (from 79 fewer to 409 more)

[a]Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[b]Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[c]Zero events in control group - risk difference entered manually for absolute effect.

Table 7: Clinical evidence summary: Percutaneous drainage vs. antibiotics

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with antibiotics	Risk difference with Percutaneous drainage (95% CI)
Mortality within 30 days of admission	2922 (1 study) 30 days	⨁⊖⊖⊖ VERY LOW[a] due to risk of bias	RR 0.34 (0.21 to 0.56)	Moderate	
				101 per 1000	67 fewer per 1000 (from 44 fewer to 80 fewer)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with antibiotics	Risk difference with Percutaneous drainage (95% CI)
Mortality within 30 days of discharge	2639 (1 study) 30 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, imprecision	RR 1.37 (0.76 to 2.46)	Moderate	
				22 per 1000	8 more per 1000 (from 5 fewer to 32 more)
Re-hospitalisation (readmission due to diverticulitis)	2922 (1 study) 30 days	⊕⊖⊖⊖ VERY LOW[a] due to risk of bias	RR 1.96 (1.44 to 2.67)	Moderate	
				53 per 1000	51 more per 1000 (from 23 more to 89 more)
Re-hospitalisation (readmission, reasons other than diverticulitis)	2922 (1 study) 30 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, imprecision	RR 1.33 (1.1 to 1.61)	Moderate	
				166 per 1000	55 more per 1000 (from 17 more to 101 more)

[a]Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[b]Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 8: Clinical evidence summary: Percutaneous drainage vs. surgery

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with surgery	Risk difference with Percutaneous drainage (95% CI)
Mortality within 30 days of admission	716 (1 study) 30 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias, imprecision	RR 0.6 (0.3 to 1.22)	Moderate	
				58 per 1000	23 fewer per 1000 (from 41 fewer to 13 more)
Mortality within 30 days of discharge	666 (1 study) 30 days	⊕⊖⊖⊖ VERY LOW[a,b] due to risk of bias,	RR 0.76 (0.32 to 1.79)	Moderate	
				40 per 1000	10 fewer per 1000 (from 27 fewer to 32 more)

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with surgery	Risk difference with Percutaneous drainage (95% CI)
		imprecision			
Re-hospitalisation (readmission due to diverticulitis)	716 (1 study) 30 days	⨁⊖⊖⊖ VERY LOW[a] due to risk of bias	RR 4.7 (1.9 to 11.63)	Moderate	
				22 per 1000	81 more per 1000 (from 20 more to 234 more)
Re-hospitalisation (readmission, reasons other than diverticulitis)	716 (1 study) 30 days	⨁⊖⊖⊖ VERY LOW[a,b] due to risk of bias, imprecision	RR 0.91 (0.68 to 1.2)	Moderate	
				243 per 1000	22 fewer per 1000 (from 78 fewer to 49 more)

[a]Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[b]Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

See appendix F for full GRADE tables.

1.5 Economic evidence

1.5.1 Included studies

No relevant health economic studies were identified.

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.

1.5.3 Unit costs

The unit costs below were presented to the Committee, to aid consideration of cost effectiveness.

Table 9: NHS costs of non-elective procedures

Procedure	Currency Description	Unit Cost	Average Length of Stay	Source
Image controlled percutaneous drainage of abdominal abscess NEC	YF04 Percutaneous Single Drainage of Abdominal Abscess, inclusive of excess bed days, weighted for complications and co morbidities for HRG codes YF04A, YF04B and YF04C; as recorded for Non-Elective Inpatients	£4,984	10.6 days	NHS Reference Costs 2016-2017
Sigmoid colectomy and anastomosis	FF33 Distal Colon Procedures, 19 years and over, inclusive of non-elective short stay and non-elective long stay with excess bed days, weighted for complications and co morbidities for HRG codes: FF33A and FF33B; as recorded for Non-Elective Inpatients	£7,091	9.0 days	NHS Reference Costs 2016-2017
Sigmoid colectomy and ileostomy HFQ Or Sigmoid colectomy and exteriorisation of bowel NEC	FF31 Complex Large Intestine Procedures, 19 years and over, inclusive of non-elective short stay and non-elective long stay with excess bed days, weighted for complications and co morbidities for HRG codes: FF31A, FF31B, FF31C and FF31D; as recorded for Non-Elective Inpatients	£8,312	11.0 days	NHS Reference Costs 2016-2017

Table 10: UK cost of antibiotics

Drug	Assumed daily dose [BNF][a]	Cost per unit (£)	Cost per course (£)[b]	Source
Intravenous				
Co-Amoxiclav 1000mg/200mg powder for solution for injection	1000mg/ 200mg every 8 hours by intravenous infusion	£1.06	£6.36[c] - £31.80[d]	BNF NHS Indicative price
Ciprofloxacin 400mg/200ml solution for infusion bottles	2x 400mg daily by intravenous infusion	£2.08	£29.12[e]	BNF NHS Indicative price
Metronidazole 500mg/100ml infusion 100ml bags	3 x 500mg daily by intravenous infusion	£3.19	£66.99[e]	BNF NHS Indicative price
Ertapenem sodium 1g powder for solution for infusion vials	1g daily by intravenous infusion	£31.86	£127.44[f]- £223.02[e]	BNF NHS Indicative Price
Piperacillin 2g/ Tazobactam 250mg powder for solution for injection vials	4.5g every 8 hours by intravenous infusion	£7.65	£321.30[e]	NHS Drug Tariff
Cefuroxime 750mg powder for solution for injection vials	1.5g every 8 hours; by intravenous infusion	£2.52	£45.36[g]	BNF NHS Indicative Price
Amoxicillin 500mg powder for solution for injection vials	3x 500mg daily by intravenous infusion	£0.55	£11.51[f]	NHS Drug Tariff
Gentamicin 240mg/80ml infusion bags	5-7mg/kg daily	£6.13	£85.80[f]	NHS Drug Tariff
Oral				
Co-Amoxiclav 500mg/125mg tablets (oral)	3 x 500mg/125mg tablets daily	£0.08	£2.36[d]	NHS Drug Tariff
Ciprofloxacin 500 mg tablets (oral)	2x 500mg tablets daily	£0.08	£1.15[e]	NHS Drug Tariff
Metronidazole 400mg tablets (oral)	3 x 400mg daily	£0.25	£5.18[e]	NHS Drug Tariff
Cefadroxil 500mg capsules (oral)	2 x 500g capsules daily	£1.12	£15.67[e]	NHS Drug Tariff
Cefuroxime 125mg tablets	4 x 125mg tablets daily	£0.33	£3.91[g]	NHS Drug Tariff
Trimethoprim 200mg tablets	2x 200mg daily	£0.07	£0.93[f]	NHS Drug Tariff
Cephalexin 500mg tablets	500mg every 8 hours	£0.08	£1.71[e]	NHS Drug Tariff

(a) Dosages for adults, British National Formulary
(b) Depending on number of units taken
(c) Cost when dose taken for 2 days
(d) Cost when dose taken for 10 days
(e) Cost when dose taken for 7 days
(f) Cost when dose taken for 4 days
(g) Cost when dose taken for 3 days

1.6 Evidence statements

1.6.1 Clinical evidence statements

Antibiotics vs surgery

Evidence from 2 studies (n=2743) of very low quality was included in the comparison between antibiotics and surgery; however the committee agreed that due to the high level of selection bias they could not determine the clinical importance of the evidence.

Percutaneous drainage + antibiotics vs antibiotics

Evidence from 4 studies (n=289) of very low quality was included in the comparison between percutaneous drainage plus antibiotics and antibiotics alone; however the committee agreed that due to the high level of selection bias they could not determine the clinical importance of the evidence.

Percutaneous drainage + antibiotics vs surgery

Evidence from a single study (n=64) of very low quality was included in the comparison between percutaneous drainage plus antibiotics and surgery; however the committee agreed that due to the high level of selection bias they could not determine the clinical importance of the evidence.

Percutaneous drainage + antibiotics + surgery vs. antibiotics + surgery

Evidence from a single study (n=146) of very low quality was included in the comparison between percutaneous drainage plus antibiotics plus surgery and antibiotics plus surgery; however the committee agreed that due to the high level of selection bias they could not determine the clinical importance of the evidence.

Percutaneous drainage vs. antibiotics

Evidence from a single study (n=2922) of very low quality was included in the comparison between percutaneous drainage and antibiotics; however the committee agreed that due to the high level of selection bias they could not determine the clinical importance of the evidence.

Percutaneous drainage vs. surgery

Evidence from a single study (n=716) of very low quality was included in the comparison between percutaneous drainage and antibiotics; however the committee agreed that due to the high level of selection bias they could not determine the clinical importance of the evidence.

1.6.2 Health economic evidence statements

No relevant economic evaluations were identified.

1.7 Recommendations

Management of abscesses

N1. For people presenting in secondary care with complicated acute diverticulitis and suspected diverticular abscess, assess and manage in line with the NICE guideline on sepsis.

N2. When prescribing an antibiotic for diverticular abscess, follow table 11 for adults aged 18 years and over.

N3. Offer intravenous antibiotics and a contrast CT scan to people with complicated acute diverticulitis and suspected diverticular abscess.

- If contrast CT is contraindicated perform a non-contrast CT if indicated.
- If CT is contraindicated consider MRI or ultrasound scan depending on local expertise.

N4. Review intravenous antibiotics within 48 hours or after scanning if sooner and consider stepping down to oral antibiotics where possible.

N5. Use the scan results to guide treatment based on the size and location of the abscess.

N6. If a person does not have confirmed diverticular abscess, review their need for antibiotics.

N7. Consider either percutaneous drainage (if anatomically feasible) or surgery for abscesses greater than 3 cm.

N8. Send samples of pus from the abscess (if it has been drained) to the microbiology laboratory to enable antibiotic therapy to be tailored to sensitivities.

N9. For abscesses less than 3 cm switch to oral antibiotics when possible.

N10. In people with a CT-confirmed diverticular abscess, if the condition does not improve clinically or there is deterioration, consider re-imaging to inform the management strategy.

Table 11:

Antibiotics for adults aged 18 years and over with acute diverticulitis

Antibiotic[1]	**Dosage and course length[2]**
First-choice oral antibiotic for uncomplicated acute diverticulitis	
Co-amoxiclav	500/125 mg three times a day for 5 days
Alternative first-choice oral antibiotics if penicillin allergy or co-amoxiclav unsuitable	
Cefalexin **with**	500 mg twice or three times a day (up to 1 to 1.5 g three or four times a day for severe infection) for 5 days
Metronidazole	400 mg three times a day for 5 days
Trimethoprim **with**	200 mg twice a day for 5 days
Metronidazole	400 mg three times a day for 5 days
Firs- choice intravenous antibiotics[3] for suspected or complicated acute diverticulitis	
Co-amoxiclav	1.2 g three times a day
Cefuroxime **with**	750 mg three or four times a day (increased to 1.5 g three or four times a day if severe infection)
Metronidazole	500 mg three times a day

Antibiotic[1]	Dosage and course length[2]
Amoxicillin **with**	500 mg three times a day (increased to 1 g four times a day if severe infection)
Gentamicin **and**	Initially 5 to 7 mg/kg once a day, subsequent doses adjusted according to serum gentamicin concentration[4]
Metronidazole	500 mg three times a day
Ciprofloxacin[5] **with**	400 mg twice or three times a day
Metronidazole	500 mg three times a day
Alternative intravenous antibiotics	
Consult local microbiologist	

[1] See BNF for appropriate use and dosing in specific populations, for example, hepatic impairment, renal impairment, pregnancy and breast-feeding, and administering intravenous antibiotics.

[2] A longer course may be needed based on clinical assessment. Continue antibiotics for up to 14 days in people with CT confirmed diverticular abscess.

[3] Review intravenous antibiotics within 48 hours or after scanning if sooner and consider stepping down to oral antibiotics where possible.

[4] Therapeutic drug monitoring and assessment of renal function is required (BNF, May 2019).

[5] Only in people with allergy to penicillins and cephalosporins. See MHRA advice for restrictions and precautions for using fluoroquinolones due to very rare reports of disabling and potentially long-lasting or irreversible side effects (March 2019).

1.8 Rationale and impact

1.8.1 Why the committee made the recommendations

The quality of the evidence for this topic meant that it was not possible to demonstrate greater effectiveness of one intervention over another. The results showed harms as well as benefits of treatment. The committee therefore made recommendations based on a combination of their clinical expertise and the approaches taken in the studies. The committee highlighted the risk of sepsis and agreed it was important to refer people with suspected diverticular abscess to secondary care for same day assessment to receive intravenous antibiotics in line with the NICE sepsis guideline (NG51). This was considered to be standard practice.

The need for intravenous antibiotics should be reviewed within 48 hours in line with current good practice on antibiotic prescribing or after the CT scan. The CT will confirm if the person has an abscess or not. The duration of antibiotics used in the studies was variable and the choice of 7 days was based on current clinical practice and the knowledge and expertise of the committee.

The committee agreed that offering a CT scan for people with suspected diverticular abscess may help to determine the most appropriate treatment for each person based on the characteristics of the abscesses, such as size and location. This was based on clinical experience and the fact that most of the included studies used CT scan to confirm and assess abscesses. MRI or ultrasound should be offered if CT is contraindicated.

The committee also decided that only abscesses greater than 3 cm should be considered for percutaneous drainage because of technical difficulties in performing this procedure on smaller abscesses. This was based on clinical expertise and was the approach taken by most of the included studies and is consistent with the committee's knowledge and experience.

The committee agreed that if percutaneous drainage is an anatomically feasible option this could be considered alongside a discussion with the patient about the risks and benefits of surgery. In people with a CT-confirmed diverticular abscess, re-imaging may be considered if the condition does not improve clinically of if there is deterioration. This will guide the management strategy – for example, if further surgery is needed or if a previous collection that was not drainable percutaneously (for example because it was too small) is now drainable.

1.8.2 Impact of the recommendations on practice

The recommendations reflect current practice and make reference to the NICE guideline on sepsis.

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 guideline committee agreed that for this review quality of life, mortality, morbidity, progression of disease, recurrence of abscess, re-hospitalisation, need for further surgery/percutaneous drainage, complications (infection, abscess, perforation, fistula, stricture and haemorrhage), anastomotic leak rate and stoma were considered critical outcomes. There were no additional outcomes that were considered to be important.

In this review, no clinical evidence was identified for the following critical outcomes; quality of life, progression of disease, recurrence of abscess, complications (infection, abscess, perforation, fistula, stricture and haemorrhage) and anastomotic leak rate.

1.9.1.2 The quality of the evidence

The evidence included in this review was of a very low quality primarily due to selection bias, a lack of participant and investigator blinding, and imprecision. Selection bias was present as factors such as abscess size and location, and the feasibility of percutaneous drainage, affected which group patients were assigned to by surgeons. All evidence was obtained from non-randomised studies, as no randomised controlled trials matching the review protocol were identified.

1.9.1.3 Benefits and harms

When discussing the evidence, the committee appreciated that in all included studies there was significant selection bias present for all of the reported outcomes due to the nature of patient assignment to each group. In particular, abscess size, location and the feasibility of percutaneous drainage impacted upon which group surgeons assigned patients to and may therefore have influenced the effects observed for the reported outcomes. Despite this, the committee felt able to make some recommendations by combining their clinical expertise and opinion with the approaches employed by the studies included in this review.

The committee stressed the importance of treating diverticular abscess with intravenous antibiotics as soon as possible due to the septic conditions and recommended that this was done in line with the existing NICE guideline on sepsis (NG51). Therefore, the committee recommended that those presenting with suspected diverticular abscess in primary care should be referred to secondary care immediately to receive intravenous antibiotics. The committee felt that intravenous antibiotics should be administered in secondary care before a CT scan was performed to avoid unnecessary delay in treating sepsis in these patients

When discussing the approaches used by each of the included studies, the committee noted that the majority had used CT scan to confirm the presence of diverticular abscess and assess the characteristics of each abscess, which ultimately impacted upon the treatment that was selected. Based on their clinical expertise, the committee agreed that percutaneous drainage is not feasible in certain cases, such as in particularly small abscesses (< 3 cm) and where the procedure would involve passing through important structures that could become damaged as a result. For this reason, the committee considered that a CT scan could be useful for confirming and assessing abscesses and selecting the most appropriate treatment based on abscess characteristics. The committee suggested that abscesses < 3 cm in size may be treated with antibiotics alone initially, as this was the approach taken in most of the included studies and was consistent with the clinical expertise of the committee. For abscesses ≥ 3 cm, percutaneous drainage (if anatomically feasible) and surgery were considered as treatment options. The choice of treatment may be determined by factors such as the patient's age, comorbidity and performance status. In cases where there is no improvement in condition or a deterioration following initial treatment, the committee felt that reimaging by CT should be considered in order to reassess the abscess characteristics and subsequent treatment options; for example, for abscesses < 3 cm that were originally treated with antibiotics only, a further CT may reveal an increase in size that makes percutaneous drainage feasible or may indicate that surgery is warranted.

The committee considered being able to recommend specific antibiotic regimens including co-amoxiclav or cefuroxime and metronidazole but evidence was limited and most trials used a variety of different antibiotics, with many suggesting the antibiotics were tailored to the sensitivities of the specimens sent. The committee also found it difficult to comment on the duration of therapy as there was very limited information in the studies included in the review. It was noted that evidence exists (but did not meet the evidence review protocol criteria) to suggest that if source control is achieved, a 4-7 day duration is sufficient however, if there is no source control the duration is difficult to determine and the duration suggested in the recommendations for abscesses < 3cm in size is taken from the wide variations in the quoted evidence.

In line with good anti-microbial stewardship the requirements for antibiotics should be reviewed in when an abscess has not been confirmed.

1.9.2 Cost effectiveness and resource use

The clinical evidence was low quality and inconclusive and there was no cost effectiveness evidence. The committee were presented with the unit costs of antibiotics, percutaneous drainage and surgery. Recommendations were made, based on the expert opinion of the Committee. The Committee recommended antibiotics in line with the NICE Sepsis guideline (NG51). They also made a recommendation in favour of either percutaneous drainage or surgery, the cost of each is substantial – from NHS reference costs £4984 for the former and £7091-£8312 for the latter. CT was also recommended to inform procedure decisions. However, these patients will require an inpatient stay even in the absence of the procedure and the incremental cost is not clear. The clinical and cost effectiveness of the procedures is not known for this population and therefore the Committee made a weak 'consider' recommendation. The recommendations do not represent a move away from current practice, which is variable.

1.9.3 Other factors the committee took into account

The committee noted that MRI or ultrasound could be used if CT is contraindicated

In people with a CT confirmed diverticular abscess, reimaging may be considered if the condition does not improve clinically of if there is deterioration. This will guide the management strategy for example if further surgery is required or if a previous collection that was not drainable percutaneously for example because it was too small is now drainable..

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Appendices

Appendix A: Review protocols

Table 12: Review protocol: Percutaneous drainage of abscesses

Field	Content
Review question	What is the clinical and cost effectiveness of percutaneous drainage versus resectional surgery for the management of abscesses?
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 whether percutaneous drainage is more clinically and cost effective than resection surgery for the management of abscesses
Eligibility criteria – population / disease / condition / issue / domain	Adults 18 years and over with acute diverticular abscesses
Eligibility criteria – intervention(s) / exposure(s) / prognostic factor(s)	• Percutaneous drainage • Antibiotics • Surgery • Combinations of treatments
Eligibility criteria – comparator(s) / control or reference (gold) standard	• Compared to each other

Outcomes and prioritisation	Critical outcomes:
	• Quality of life
	• Mortality
	• Morbidity
	• Progression of disease
	• recurrence of abscess
	• Complications:
	  ○ infections
	  ○ abscesses
	  ○ perforation
	  ○ fistula
	  ○ stricture
	  ○ haemorrhage
	• Re-hospitalisation
	• Need for further surgery/percutaneous drain
	• Anastomotic leak rate
	• Stoma

Eligibility criteria – study design	Randomised controlled trials (RCTs), systematic reviews of RCTs. If no sufficient RCT evidence is available, search for observational studies

Other inclusion exclusion criteria	Exclusions: • Children and young people aged 17 years and younger
Proposed sensitivity / subgroup analysis, or meta-regression	Subgroups: • people of Asian family origin as they are known to develop right-sided diverticula • immunocompromised population • Aged <50 years, ≥50 years • Abscess size <6 cm, ≥ 6 cm
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	A multidisciplinary committee developed the evidence review. The

authors and guarantor	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

1 **Table 13: 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).[20] **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.

B.1 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.

1 **Table 14: Database date parameters and filters used**

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

2 **Table 15: 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)

Table 16: 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 17: Cochrane Library (Wiley) search terms

#1.	diverticul*.mp.

B.2 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 18: 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 19: 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 20: 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

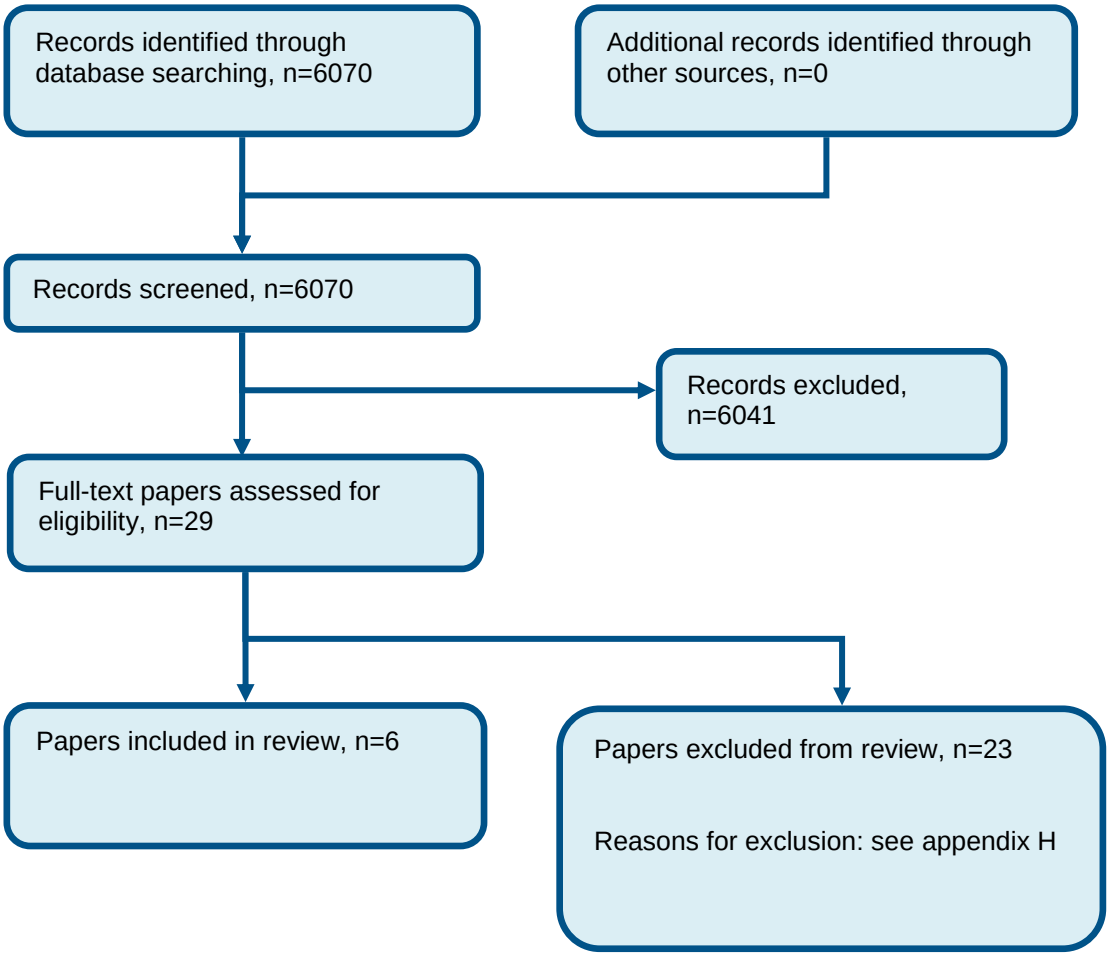
83.	19 and (36 or 60 or 82)

Table 21: 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 percutaneous drainage of abscesses



1

2

Appendix D: Clinical evidence tables

Table 22: Clinical evidence tables

Study	Buchwald 2017[3]
Study type	Retrospective cohort study
Number of studies (number of participants)	1 (n=107)
Countries and setting	Conducted in New Zealand; Setting: Hospital - secondary care
Line of therapy	1st line
Duration of study	Follow up (post intervention): 110 months (mean follow-up)
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Diverticulitis diagnosed based on clinical findings, blood tests, endoscopic and/or surgical finding and radiology. CT scan performed in all patients.
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Sigmoid diverticulitis diagnosis
Exclusion criteria	Those with previous diverticular attacks. Post-operative abscesses. Patients with charts unavailable for validation and or that had right-sided diverticulitis.
Recruitment/selection of patients	Retrospective review of patients with abscess due to diverticulitis in a diverticulitis database that was prospectively collected between 1998 and 2009.
Age, gender and ethnicity	Age - Mean (SD): Antibiotics, 60.5 (17.6) years; percutaneous drainage + antibiotics, 71.5 (13.6) years; surgery, 65.5 (13.4) years.. Gender (M:F): Antibiotics, 25/17; percutaneous drainage + antibiotics, 13/9; surgery, 22/21.. Ethnicity: Not reported.
Further population details	
Extra comments	Localisation of abscess (proportions of pericolic, mesocolic and pelvic) differed between groups.. Followed up until 1st January 2014
Indirectness of population	No indirectness
Interventions	(n=43) Intervention 1: Antibiotics. No details given concerning type, dose or duration of treatment with antibiotics. Mean abscess size, 3.1±1.8 cm. Localisation of abscess: pericolic, 20; mesocolic, 10; and pelvic, 13.. Duration Not

	reported.. Concurrent medication/care: Some patients in the complete cohort were taking NSAIDs, steroids or being treated for diabetes, but does not specify whether this differed between the different intervention groups. . Indirectness: No indirectness (n=22) Intervention 2: Combinations of treatments. No details given concerning type, dose or duration of treatment with antibiotics. Mean abscess size, 5.6±2.4 cm. Localisation of abscess: pericolic, 5; mesocolic, 4; and pelvic, 13.. Duration Not reported.. Concurrent medication/care: Some patients in the complete cohort were taking NSAIDs, steroids or being treated for diabetes, but does not specify whether this differed between the different intervention groups. . Indirectness: No indirectness (n=42) Intervention 3: Surgery. Procedures included laparotomy and drainage (n=3), sigmoid resection with primary anastomosis (n=24) and Hartmann's procedure (n=15). Mean abscess size, 4.6±1.6 cm. Localisation of abscess: pericolic, 17; mesocolic, 12; and pelvic, 13.. Duration Not reported.. Concurrent medication/care: Some patients in the complete cohort were taking NSAIDs, steroids or being treated for diabetes, but does not specify whether this differed between the different intervention groups. . Indirectness: No indirectness
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: ANTIBIOTICS versus SURGERY

Protocol outcome 1: Re-hospitalisation at Define
- Actual outcome: Readmission due to diverticulitis at 110 months; Group 1: 13/43, Group 2: 2/42
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - High, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Abscess size differs between the groups. Age differs quite substantially between groups.; Key confounders: Age, gender; Group 1 Number missing: ; Group 2 Number missing:

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS DRAINAGE + ANTIBIOTICS versus ANTIBIOTICS

Protocol outcome 1: Re-hospitalisation at Define
- Actual outcome: Readmission due to diverticulitis at 110 months; Group 1: 6/22, Group 2: 13/43
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - High, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference in proportion of abscesses with pericolic, mesocolic and pelvic localisation between groups. Abscess size differs between the groups.; Key confounders: Age, gender; Group 1 Number missing: ; Group 2 Number missing:

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS DRAINAGE + ANTIBIOTICS versus SURGERY

Protocol outcome 1: Re-hospitalisation at Define - Actual outcome: Readmission due to diverticulitis at 110 months; Group 1: 6/22, Group 2: 2/42 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Difference in proportion of males to females and abscesses with pericolic, mesocolic and pelvic localisation between groups. Abscess size differs between the groups.; Key confounders: Age, gender; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Mortality at Define; Morbidity at Define; Progression of disease at Define; Complications (infections) at Define; Complications (abscesses) at Define; Complications (perforation) at Define; Complications (fistula) at Define; Complications (stricture) at Define; Recurrence of abscess at Define; Need for further surgery/percutaneous drain at Define; Anastomotic leak rate at Define; Complications (haemorrhage) at Define; Stoma at Define

Study	Elagili 2015[6]
Study type	Retrospective cohort study
Number of studies (number of participants)	1 (n=164)
Countries and setting	Conducted in USA; Setting: Digestive disease institute, Cleveland clinic.
Line of therapy	Mixed line
Duration of study	Other: Retrospective study, analysing results from 1994 to 2012
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: CT imaging
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	All patients with an abscess of at least 3 cm in diameter associated with sigmoid diverticulitis admitted to our institution from 1994 to 2012 were identified from an institutional review board-approved diverticular database and retrospectively reviewed. Both diagnosis and diameter measurement of the diverticular abscess were based on computed tomography (CT) imaging. All patients eventually underwent surgery for pathology-proven sigmoid diverticulitis.
Exclusion criteria	Exclusion criteria were requirement for urgent or emergent surgery decided immediately following admission, treatment consisting of antibiotics or PD alone without subsequent surgery, diverticular abscesses having a diameter of less than 3 cm and/or reported as incidental findings in the course of treatment for other presentations of complicated diverticular disease.
Recruitment/selection of patients	Patients admitted between 1994 to 2012 were identified from an institutional review board-approved diverticular database and retrospectively reviewed.
Age, gender and ethnicity	Age - Median (range): 55.5 (36-82) antibiotics+surgery group, 56.5 (25-85) PD+antibiotics+surgery group. . Gender (M:F): female percentage: 54% antibiotics+surgery group, 46% PD+antibiotics+surgery group. . Ethnicity: Not stated
Further population details	
Extra comments	.
Indirectness of population	No indirectness
Interventions	(n=32) Intervention 1: Combinations of treatments. Antibiotics and surgery: wide-spectrum intravenous antibiotics progressively switched to oral formulations at the discretion of the individual surgeon during a total treatment course of 1–3 weeks followed by emergency or elective surgery. . Duration Mean (range) days: 12 (3-56). Concurrent medication/care: emergency surgery was determined by treatment failure.

	Indirectness: No indirectness (n=114) Intervention 2: Combinations of treatments. Percutaneous drainage, antibiotics and surgery: percutaneous drainage and wide-spectrum intravenous antibiotics progressively switched to oral formulations at the discretion of the individual surgeon during a total treatment course of 1–3 weeks followed by emergency or elective surgery. . Duration Mean (range) days: 11 (2-52). Concurrent medication/care: emergency surgery was determined by treatment failure. Indirectness: No indirectness
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: COMBINATIONS OF TREATMENTS (PD, ANTIBIOTICS, SURGERY) versus COMBINATIONS OF TREATMENTS (ANTIBIOTICS, SURGERY) Protocol outcome 1: Mortality at Define - Actual outcome: Mortality at Not stated; Group 1: 3/114, Group 2: 0/32 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 2: Morbidity at Define - Actual outcome: Overall morbidity at Not stated; Group 1: 42/114, Group 2: 11/32 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing: Protocol outcome 3: Stoma at Define - Actual outcome: Overall stoma rate at Not stated; Group 1: 51/114, Group 2: 11/32 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: ; Group 2 Number missing:	
Protocol outcomes not reported by the study	Quality of life at Define; Progression of disease at Define; Complications (infections) at Define; Complications (abscesses) at Define; Complications (perforation) at Define; Complications (fistula) at Define; Complications (stricture) at Define; Recurrence of abscess at Define; Re-hospitalisation at Define; Need for further surgery/percutaneous drain at Define; Anastomotic leak rate at Define; Complications (haemorrhage) at Define

Study	Gregersen 2016[9]
Study type	Retrospective cohort study
Number of studies (number of participants)	1 (n=3148)
Countries and setting	Conducted in Denmark; Setting: Secondary care - inpatients and outpatients
Line of therapy	1st line
Duration of study	Follow up (post intervention): Database including entire Danish population between 2000 and 2012. For those alive from 2000 to 2012, admissions between 1995 and 1999 were available as a retrospective follow-up.
Method of assessment of guideline condition	Unclear method of assessment/diagnosis: Does not specify how diverticular abscess was diagnosed before treatment in the patients included in the database.
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients were included if the following criteria were met based on data in a database that combined the Danish Civil Registration System, the Danish National patient Register and the Register of Medicinal Product Statistics: Patients registered with'colon diverticulitis with abscess'; patients that were registered with 'colon diverticulitis with abscess and/or perforation' who had not undergone colonic surgery or peritoneal lavage during admission; patients registered with uncomplicated diverticulitis combined with a diagnosis code for intestinal or intraabdominal abscess during the same admission; and patients registered with uncomplicated diverticulitis combined with a procedural code for abscess drainage.
Exclusion criteria	Patients admitted <30 days before the end of the study, leading to <30 days follow-up; patients with no available demographic data; patients with a temporary civil registration number, which are given to tourists requiring emergency health care.
Recruitment/selection of patients	All patients matching inclusion criteria in the database between 2000 and 2012.
Age, gender and ethnicity	Age - Mean (SD): Antibiotics, 65.6 (15.4) years; non-surgical drainage, 63.5 (14.9) years; operative, 63.7 (15) years.. Gender (M:F): Antbiotics, 1032/1400; non-surgical drainage, 189/301; operative, 114/112.. Ethnicity: Not reported.
Further population details	
Extra comments	Each group included some patients that had experienced previous episodes of uncomplicated diverticulitis, which was comparable between all three groups. However, the proportion of those in each group that had experienced a previous episode of complicated diverticulitis (any complication, not only abscess) differed among the groups: Antibiotics, 11.4%; non-surgical drainage, 3.5%; and operative, 0%. Could not determine abscess size in the different groups, which may contribute to selection bias.

Indirectness of population	No indirectness
Interventions	(n=2432) Intervention 1: Antibiotics. Antibiotic treatment could not be extracted from the registers the study used. Therefore, this group represents those that did were not in the non-surgical drainage or operative groups, and patients in this group may have received antibiotics only or no antibiotics. . Duration Not reported.. Concurrent medication/care: Not reported.. Indirectness: No indirectness (n=490) Intervention 2: Percutaneous drainage. Patients underwent non-surgical abscess drainage with a transabdominal, transvaginal or transrectal approach.. Duration Not reported.. Concurrent medication/care: Not reported.. Indirectness: No indirectness (n=226) Intervention 3: Surgery. Operative group included those that underwent colonic surgery or surgical abscess drainage during admission.. Duration Not reported.. Concurrent medication/care: Not reported.. Indirectness: No indirectness
Funding	No funding

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: ANTIBIOTICS versus SURGERY

Protocol outcome 1: Mortality at Define
- Actual outcome: Mortality within 30 days from admission at 30 days; Group 1: 245/2432, Group 2: 13/226
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Proportion of patients with a previous episode of complicated diverticulitis not comparable between groups (11.4% vs 0%). Could not compare abscess size between the groups. Age, M/F ratio and comorbidity were similar between groups.; Key confounders: Age. gender; Blinding details: Retrospective data from a database - would not have been blinded as data came from national records; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome: Mortality within 30 days from discharge at 30 days; Group 1: 48/2175, Group 2: 8/202
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Proportion of patients with a previous episode of complicated diverticulitis not comparable between groups (11.4% vs 0%). Could not compare abscess size between the groups. Age, M/F ratio and comorbidity were similar between groups.; Key confounders: Age. gender; Blinding details: Retrospective data from a database - would not have been blinded as data came from national records; Group 1 Number missing: 257; Group 2 Number missing: 24

Protocol outcome 2: Re-hospitalisation at Define
- Actual outcome: Readmission within 30 days from discharge (excluding those due to recurrent/persistent diverticulitis) at 30 days; Group 1: 403/2432, Group 2: 55/226
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover -

Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Proportion of patients with a previous episode of complicated diverticulitis not comparable between groups (11.4% vs 0%). Could not compare abscess size between the groups. Age, M/F ratio and comorbidity were similar between groups.; Key confounders: Age. gender; Blinding details: Retrospective data from a database - would not have been blinded as data came from national records; Group 1 Number missing: , Reason: Some patients may have died before being readmitted while others may have died following readmission. Number unclear.; Group 2 Number missing: , Reason: Some patients may have died before being readmitted while others may have died following readmission. Number unclear.
- Actual outcome: Readmission due to diverticulitis within 30 days from discharge at 30 days; Group 1: 129/2432, Group 2: 5/226
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Proportion of patients with a previous episode of complicated diverticulitis not comparable between groups (11.4% vs 0%). Could not compare abscess size between the groups. Age, M/F ratio and comorbidity were similar between groups.; Key confounders: Age. gender; Blinding details: Retrospective data from a database - would not have been blinded as data came from national records; Group 1 Number missing: , Reason: Some patients may have died before being readmitted while others may have died following readmission. Number unclear.; Group 2 Number missing: , Reason: Some patients may have died before being readmitted while others may have died following readmission. Number unclear.

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS DRAINAGE (NON-SURGICAL DRAINAGE) versus ANTIBIOTICS

Protocol outcome 1: Mortality at Define
- Actual outcome: Mortality within 30 days from admission at 30 days; Group 1: 17/490, Group 2: 245/2432
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Proportion of patients with a previous episode of complicated diverticulitis not comparable between groups (11.4% vs. 3.5%). Could not compare abscess size between the groups. Age, M/F ratio and comorbidity were similar between groups.; Key confounders: Age. gender; Blinding details: Retrospective data from a database - would not have been blinded as data came from national records; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome: Mortality within 30 days from discharge at 30 days; Group 1: 14/464, Group 2: 48/2175
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low, Comments - ; Indirectness of outcome: No indirectness ; Baseline details: Proportion of patients with a previous episode of complicated diverticulitis not comparable between groups (11.4% vs. 3.5%). Could not compare abscess size between the groups. Age, M/F ratio and comorbidity were similar between groups.; Key confounders: Age. gender; Blinding details: Retrospective data from a database - would not have been blinded as data came from national records; Group 1 Number missing: 26, Reason: Some patients may have died in period before discharge. Other reasons not specified.; Group 2 Number missing: 257, Reason: Some patients may have died in period before discharge. Other reasons not specified.

Protocol outcome 2: Re-hospitalisation at Define
- Actual outcome: Readmission within 30 days from discharge (excluding those due to recurrent/persistent diverticulitis) at 30 days; Group 1: 108/490, Group 2: 403/2432
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Proportion of patients with a previous episode of complicated diverticulitis not comparable between groups (11.4% vs. 3.5%). Could not compare abscess size between the groups. Age, M/F ratio and comorbidity were similar

between groups.; Key confounders: Age. gender; Blinding details: Retrospective data from a database - would not have been blinded as data came from national records; Group 1 Number missing: , Reason: Some patients may have died before being readmitted while others may have died following readmission. Number unclear.; Group 2 Number missing: , Reason: Some patients may have died before being readmitted while others may have died following readmission. Number unclear.
- Actual outcome: Readmission due to diverticulitis within 30 days from discharge at 30 days; Group 1: 51/490, Group 2: 129/2432
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Proportion of patients with a previous episode of complicated diverticulitis not comparable between groups (11.4% vs. 3.5%). Could not compare abscess size between the groups. Age, M/F ratio and comorbidity were similar between groups.; Key confounders: Age. gender; Blinding details: Retrospective data from a database - would not have been blinded as data came from national records; Group 1 Number missing: , Reason: Some patients may have died before being readmitted while others may have died following readmission. Number unclear.; Group 2 Number missing: , Reason: Some patients may have died before being readmitted while others may have died following readmission. Number unclear.

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS DRAINAGE (NON-SURGICAL DRAINAGE) versus SURGERY

Protocol outcome 1: Mortality at Define
- Actual outcome: Mortality within 30 days from admission at 30 days; Group 1: 17/490, Group 2: 13/226
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Proportion of patients with a previous episode of complicated diverticulitis not comparable between groups (3.5% vs. 0$). M/F ratio not comparable between groups. Could not compare abscess size between the groups. Age and comorbidity were similar between groups.; Key confounders: Age. gender; Blinding details: Retrospective data from a database - would not have been blinded as data came from national records; Group 1 Number missing: ; Group 2 Number missing:
- Actual outcome: Mortality within 30 days from discharge at 30 days; Group 1: 14/464, Group 2: 8/202
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low, Comments - ; Indirectness of outcome: No indirectness ; Baseline details: Proportion of patients with a previous episode of complicated diverticulitis not comparable between groups (3.5% vs. 0%). Could not compare abscess size between the groups. M/F ratio not comparable between groups. Age and comorbidity were similar between groups.; Key confounders: Age. gender; Blinding details: Retrospective data from a database - would not have been blinded as data came from national records; Group 1 Number missing: 26, Reason: Some patients may have died in period before discharge. Other reasons not specified.; Group 2 Number missing: 24, Reason: Some patients may have died in period before discharge. Other reasons not specified.

Protocol outcome 2: Re-hospitalisation at Define
- Actual outcome: Readmission within 30 days from discharge (excluding those due to recurrent/persistent diverticulitis) at 30 days; Group 1: 108/490, Group 2: 55/226
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Proportion of patients with a previous episode of complicated diverticulitis not comparable between groups (3.5% vs. 0%). Could not compare abscess size between the groups. M/F ratio not comparable between groups. Age and comorbidity were similar between groups.; Key confounders: Age. gender; Blinding details: Retrospective data from a database - would not have been blinded as data came from national records; Group 1 Number missing: , Reason: Some patients may have died before being readmitted while others may have died following readmission. Number unclear.; Group 2 Number missing: , Reason: Some patients may have died before being readmitted while others may have died following

readmission. Number unclear. - Actual outcome: Readmission due to diverticulitis within 30 days from discharge at 30 days; Group 1: 51/490, Group 2: 5/226 Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Proportion of patients with a previous episode of complicated diverticulitis not comparable between groups (3.5% vs. 0%). Could not compare abscess size between the groups. M/F ratio not comparable between groups. Age and comorbidity were similar between groups.; Key confounders: Age. gender; Blinding details: Retrospective data from a database - would not have been blinded as data came from national records; Group 1 Number missing: , Reason: Some patients may have died before being readmitted while others may have died following readmission. Number unclear.; Group 2 Number missing: , Reason: Some patients may have died before being readmitted while others may have died following readmission. Number unclear.	
Protocol outcomes not reported by the study	Quality of life at Define; Morbidity at Define; Progression of disease at Define; Complications (infections) at Define; Complications (abscesses) at Define; Complications (perforation) at Define; Complications (fistula) at Define; Complications (stricture) at Define; Recurrence of abscess at Define; Need for further surgery/percutaneous drain at Define; Anastomotic leak rate at Define; Complications (haemorrhage) at Define; Stoma at Define

Study	Kaiser 2005[13]
Study type	Retrospective cohort study
Number of studies (number of participants)	1 (n=511)
Countries and setting	Conducted in USA; Setting: Hospital
Line of therapy	1st line
Duration of study	Follow up (post intervention): Review of patients treated for acute diverticulitis in 10 year time-period (January 1994 to December 2003).
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: CT scan used to confirm abscess in stage Ib and II complicated diverticulitis.
Stratum	Overall
Subgroup analysis within study	Not stratified but pre-specified: Subgrouped by age group.
Inclusion criteria	People treated for acute diverticulitis within 10 year time-period between January 1994 and December 2003.
Exclusion criteria	Patients admitted primarily for stoma reversal after diverticular surgery; patients that were found to have colon cancer that mimicked acute diverticulitis; patients with relevant data deficiencies.
Recruitment/selection of patients	All patients treated for acute diverticulitis within 10 year time-period between January 1994 and December 2003.
Age, gender and ethnicity	Age - Mean (range): Abscess complication group (Ib and II stages): 46.26 (22-80) years.. Gender (M:F): Total cohort (not specifically those complicated by abscess), 296/215.. Ethnicity: Not reported.
Further population details	
Extra comments	Data from this study was extracted only for the abscess complication - age and M/F ratio were not available for this subgroup.
Indirectness of population	No indirectness
Interventions	(n=16) Intervention 1: Combinations of treatments. All patients started on appropriate broad spectrum antibiotics, which included coverage for gram-negative and anaerobic bacteria that are commonly involved in colonic infections. Percutaneous drainage performed in those where the abscess was of a sufficient size and in a favourable location to be considered amenable to drainage. Mean abscess size, 7.1±1.9 cm.. Duration Not reported.. Concurrent medication/care: Not reported.. Indirectness: No indirectness Comments: Patients in this group considered to have abscesses amenable to CT-guided drainage, based on size and/or location. (n=83) Intervention 2: Antibiotics. All patients started on appropriate broad spectrum antibiotics, which included

	coverage for gram-negative and anaerobic bacteria that are commonly involved in colonic infections. Mean abscess size, 3.6±2.3 cm.. Duration Not reported.. Concurrent medication/care: Not reported.. Indirectness: No indirectness Comments: Patients in this group were considered to have abscesses that were not amenable to CT-guided drainage, based on size and/or location.
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS DRAINAGE + ANTIBIOTICS versus ANTIBIOTICS

Protocol outcome 1: Re-hospitalisation at Define
- Actual outcome: Recurrence of diverticulitis after discharge from index admission at During follow-up (mean, 46.5 months for whole cohort); Group 1: 5/12, Group 2: 9/60
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - High, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Age and M/F ratio not reported for each intervention. Abscess size differed substantially. Comorbidity and history of diverticulitis not reported for each intervention. Higher proportion of pericolonic (stage Ib) abscesses in the antibiotics only group.; Key confounders: Age, gender; Group 1 Number missing: 4, Reason: No follow-up data.; Group 2 Number missing: 23, Reason: No follow-up data.

Protocol outcome 2: Need for further surgery/percutaneous drain at Define
- Actual outcome: Need for further surgery at admission and during follow-up (follow-up duration not specified); Group 1: 9/16, Group 2: 34/83; Comments: Includes emergency and elective surgery procedures.
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - High, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness; Baseline details: Age and M/F ratio not reported for each intervention. Abscess size differed substantially. Comorbidity and history of diverticulitis not reported for each intervention. Higher proportion of pericolonic (stage Ib) abscesses in the antibiotics only group.; Key confounders: Age, gender; Group 1 Number missing: , Reason: Not all of the admitted patients were followed up - some without follow-up data may have had these events. Does not specify the number.; Group 2 Number missing: , Reason: Not all of the admitted patients were followed up - some without follow-up data may have had these events. Does not specify the number.

Protocol outcome 3: Stoma at Define
- Actual outcome: Two-stage resection (stoma) at admission and during follow-up (follow-up duration not specified); Group 1: 3/16, Group 2: 7/83; Comments: Stoma closure rate for whole cohort was 63.6%. Rate for the abscess subgroup not given.
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - High, Outcome reporting - High, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Age and M/F ratio not reported for each intervention. Abscess size differed substantially. Comorbidity and history of diverticulitis not reported for each intervention. Higher proportion of pericolonic (stage Ib) abscesses in the antibiotics only group.; Key confounders: Age, gender; Group 1 Number missing: , Reason: Not all of the admitted patients were followed up - some without follow-up data may have had these events. Does not specify the number missing for this group.; Group 2 Number missing: , Reason: Not all of the admitted patients were followed up - some

without follow-up data may have had these events. Does not specify the number missing for this group.	
Protocol outcomes not reported by the study	Quality of life at Define; Mortality at Define; Morbidity at Define; Progression of disease at Define; Complications (infections) at Define; Complications (abscesses) at Define; Complications (perforation) at Define; Complications (fistula) at Define; Complications (stricture) at Define; Recurrence of abscess at Define; Anastomotic leak rate at Define; Complications (haemorrhage) at Define

Study	Siewert 2006[25]
Study type	Retrospective cohort study
Number of studies (number of participants)	1 (n=181)
Countries and setting	Conducted in Unknown; Setting: Tertiary care medical center and major teaching hospital.
Line of therapy	1st line
Duration of study	Follow up (post intervention): Minimum 50 days after first presentation of diverticulitis.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: CT scans reviewed retrospectively by two radiologists blinded to clinical, surgical and pathological findings.
Stratum	Overall
Subgroup analysis within study	Post-hoc subgroup analysis: Separated data into small and large abscesses when stating outcomes. Not clear if this was pre-specified. Extracted data only for the large abscess subgroup as small abscesses were all treated by the same method.
Inclusion criteria	CT scan demonstrating presence of diverticulitis and abscess.
Exclusion criteria	Patients with no signs of acute diverticulitis. Patients with no follow-up information for outcomes.
Recruitment/selection of patients	Searched computer database at the centre/hospital containing all reports of CT scans of abdomen and pelvis using the keyword 'diverticulitis'.
Age, gender and ethnicity	Age - Mean (SD): Large abscess subgroup, 55.3 (40–74) years.. Gender (M:F): Large abscess subgroup, 5/3.. Ethnicity: Not reported.
Further population details	
Extra comments	Abscesses in this subgroup were ≥3 cm. Included some with previous history of diverticulitis.
Indirectness of population	No indirectness
Interventions	(n=4) Intervention 1: Combinations of treatments. CT-guided percutaneous drainage performed within 24 h. Mean abscess size, 5.9 cm (range, 4.9-6.7 cm). No details of type, dose or duration of antibiotics received.. Duration NA. Concurrent medication/care: Not reported.. Indirectness: No indirectness (n=4) Intervention 2: Antibiotics. Antibiotics only. No details of type, dose or duration of antibiotics received. Mean abscess size, 3.8 cm (range, 3.4-4.1 cm). Duration Not reported.. Concurrent medication/care: Not reported.. Indirectness: No indirectness Comments: People in this group were unable to have percutaneous drainage as they had abscesses that were

	considered to be unfeasible for percutaneous drainage, as they could not be reached percutaneously without passing traversing vital structures such as small or large bowel loops or large vessels.
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS DRAINAGE + ANTIBIOTICS versus ANTIBIOTICS Protocol outcome 1: Need for further surgery/percutaneous drain at Define - Actual outcome: Need for further surgery/percutaneous drain at Follow-up (range, 50-758 days); Group 1: 4/4, Group 2: 3/4; Comments: In the antibiotics group, although interval surgery was recommended in 3/4 individuals, it was only performed in 1/4 due to refusing surgery or lack of surgical evaluation/intervention for reasons unspecified in the clinical record. Type of follow-up varied for individual patients - some followed up by CT others clinically. Risk of bias: All domain - Very high, Selection - Very high, Blinding - Very high, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low, Comments - ; Indirectness of outcome: No indirectness ; Baseline details: Range of ages differed between groups, particularly important as only 4 cases in each group.; Key confounders: Age, gender; Blinding details: Outcome partially subjective as clinician would decide whether they required further surgery/drain; Group 1 Number missing: , Reason: Patients with no follow-up information regarding outcomes were excluded prior to retrospectively reviewing the data. Number missing for this group not specified.; Group 2 Number missing: , Reason: Patients with no follow-up information regarding outcomes were excluded prior to retrospectively reviewing the data. Number missing for this group not specified.	
Protocol outcomes not reported by the study	Quality of life at Define; Mortality at Define; Morbidity at Define; Progression of disease at Define; Complications (infections) at Define; Complications (abscesses) at Define; Complications (perforation) at Define; Complications (fistula) at Define; Complications (stricture) at Define; Recurrence of abscess at Define; Re-hospitalisation at Define; Anastomotic leak rate at Define; Complications (haemorrhage) at Define; Stoma at Define

Study	Subhas 2014[26]
Study type	Retrospective cohort study
Number of studies (number of participants)	1 (n=117)
Countries and setting	Conducted in USA; Setting: Secondary care - hospital
Line of therapy	1st line
Duration of study	Follow up (post intervention): Reviewed records of patients presenting with CT-scan proven left-sided diverticular abscess during 3-year period (July 2008-June 2011).
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: CT scan used to confirm diverticular abscess.
Stratum	Overall
Subgroup analysis within study	Unclear: Data from a database divided into different groups based on number of drainages performed. Unclear if these were pre-specified or decided after seeing the data.
Inclusion criteria	Not reported.
Exclusion criteria	Not reported.
Recruitment/selection of patients	All inpatients that presented with CT scan-proven left-sided diverticular abscess between July 2008 and June 2011.
Age, gender and ethnicity	Age - Mean (range): Antibiotics, 62 (25-92) years; percutaneous drainage + antibiotics, 61 (26-91) years.. Gender (M:F): Define. Ethnicity: Not reported.
Further population details	
Extra comments	Age and M/F ratio comparable between groups. Abscess size differed. No details on proportion that had experienced previous episodes of diverticulitis (uncomplicated or complicated).
Indirectness of population	No indirectness
Interventions	(n=42) Intervention 1: Combinations of treatments. All patients treated with parenteral antibiotics against Gram-negative and anaerobic bacteria while in hospital. Abscesses sent for culture and sensitivity to guide the choice of antibiotics. Drainage included simple aspiration of the collection to the placement of drains. Includes those that underwent 1 or more percutaneous drainages. Mean (range) maximum size of abscess cavity: 6 (2-19.1) cm.. Duration Not reported.. Concurrent medication/care: Not reported. . Indirectness: No indirectness Comments: Only abscesses >2 cm were considered for treatment with CT-guided percutaneous drainage. Some abscesses >2 cm did not receive percutaneous drainage if the radiologist did not consider the procedure to be safe. (n=75) Intervention 2: Antibiotics. No details concerning dose or duration of antibiotic treatment. Mean (range)

	maximum size of abscess cavity: 3 (0.7-8) cm.. Duration Not reported.. Concurrent medication/care: Not reported.. Indirectness: No indirectness Comments: This group included those with abscesses <2 cm, or with abscesses >2 cm that were considered unsafe for percutaneous drainage.
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PERCUTANEOUS DRAINAGE + ANTIBIOTICS versus ANTIBIOTICS

Protocol outcome 1: Need for further surgery/percutaneous drain at Define
- Actual outcome: Need for further surgery/percutaneous drainage at 3 year time-period; Group 1: 29/42, Group 2: 46/75; Comments: Note this is the number that had further drains and/or surgery after the initial intervention. For the drainage group, 13 had a further drainage and then went on to receive surgery - in this case, only the further drainage has been included in the total number of events to avoid double counting.
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Maximal abscess size differed between the two groups. Age and M/F ratio comparable. No details concerning number of previous uncomplicated/complicated diverticulitis episodes experienced. No comorbidity details.; Key confounders: Age, gender; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcome 2: Stoma at Define
- Actual outcome: Hartmann's procedure (stoma) at 3 year time-period; Group 1: 13/42, Group 2: 14/75; Comments: No details on number of stomas that were successfully reversed in each group.
Risk of bias: All domain - Very high, Selection - Very high, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low; Indirectness of outcome: No indirectness ; Baseline details: Maximal abscess size differed between the two groups. Age and M/F ratio comparable. No details concerning number of previous uncomplicated/complicated diverticulitis episodes experienced. No comorbidity details.; Key confounders: Age, gender; Group 1 Number missing: ; Group 2 Number missing:

Protocol outcomes not reported by the study	Quality of life at Define; Mortality at Define; Morbidity at Define; Progression of disease at Define; Complications (infections) at Define; Complications (abscesses) at Define; Complications (perforation) at Define; Complications (fistula) at Define; Complications (stricture) at Define; Recurrence of abscess at Define; Re-hospitalisation at Define; Anastomotic leak rate at Define; Complications (haemorrhage) at Define

Appendix E: Forest plots

E.1 Antibiotics vs. surgery

Figure 2: Re-hospitalisation (readmission due to diverticulitis)

Study or Subgroup	Antibiotics Events	Antibiotics Total	Surgery Events	Surgery Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Buchwald 2017	13	43	2	42	18.1%	6.35 [1.52, 26.44]
Gregersen 2016	129	2432	5	226	81.9%	2.40 [0.99, 5.80]
Total (95% CI)		**2475**		**268**	**100.0%**	**3.11 [1.49, 6.49]**
Total events	142		7			

Heterogeneity: Chi² = 1.29, df = 1 (P = 0.26); I² = 23%
Test for overall effect: Z = 3.03 (P = 0.002)

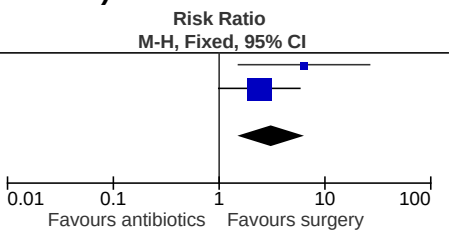


Figure 3: Mastality within 30 days of admission

Study or Subgroup	Antibiotics Events	Antibiotics Total	Surgery Events	Surgery Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Gregersen 2016	245	2432	13	226		1.75 [1.02, 3.01]

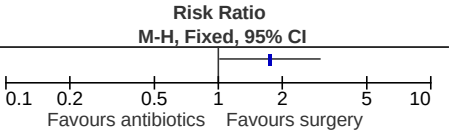


Figure 4: Mortality within 30 days of discharge

Study or Subgroup	Antibiotics Events	Antibiotics Total	Surgery Events	Surgery Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Gregersen 2016	48	2175	8	202		0.56 [0.27, 1.16]

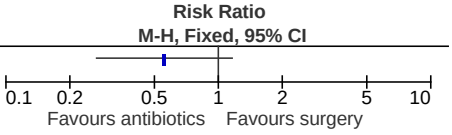
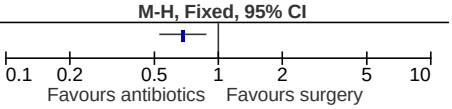


Figure 5: Re-hospitalisation (readmission, reasons other than diverticulitis)

Study or Subgroup	Antibiotics Events	Antibiotics Total	Surgery Events	Surgery Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Gregersen 2016	403	2432	55	226		0.68 [0.53, 0.87]



E.2 Percutaneous drainage + antibiotics vs. antibiotics

Figure 6: Re-hospitalisation (readmission due to diverticulitis)

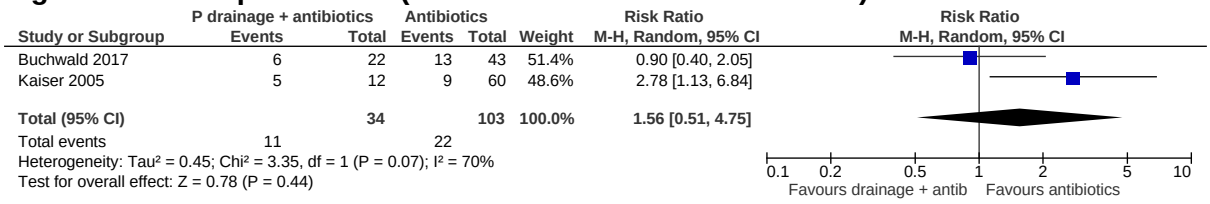


Figure 7: Need for further surgery/percutaneous drain

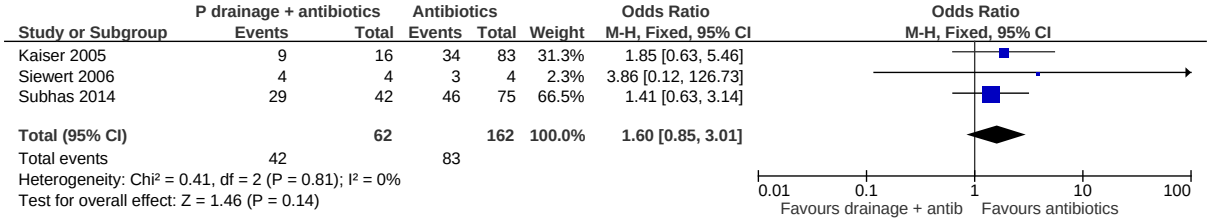
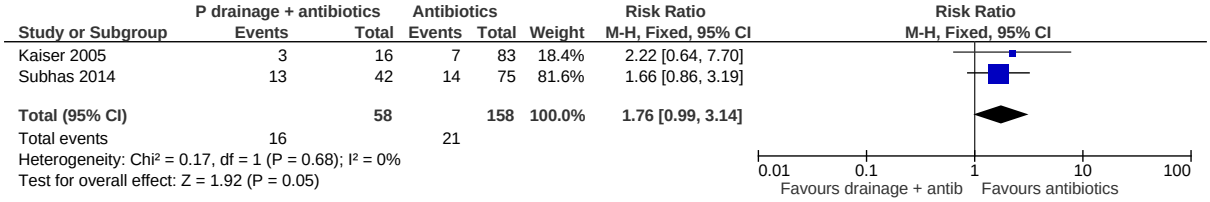
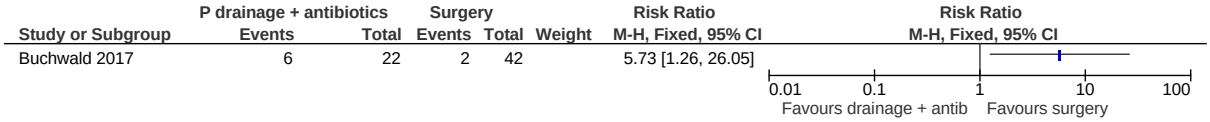


Figure 8: Stoma creation



E.3 Percutaneous drainage + antibiotics vs. surgery

Figure 9: Re-hospitalisation (readmission due to diverticulitis)



E.4 Percutaneous drainage + antibiotics + surgery vs. antibiotics + surgery

Figure 10: Mortality

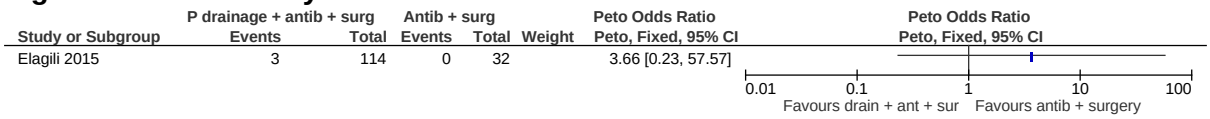


Figure 11: Overall morbidity

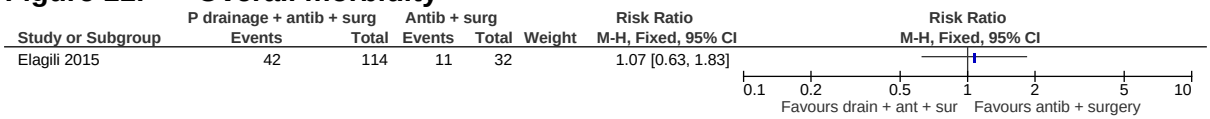
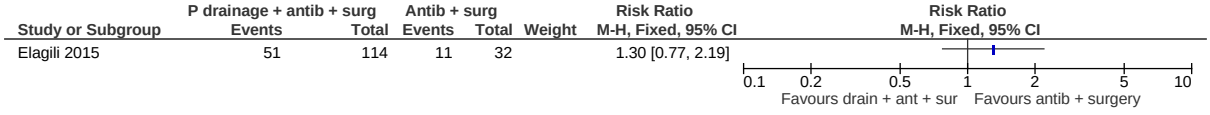


Figure 12: Overall stoma rate



E.5 Percutaneous drainage vs. antibiotics

Figure 13: Mortality within 30 days of admission

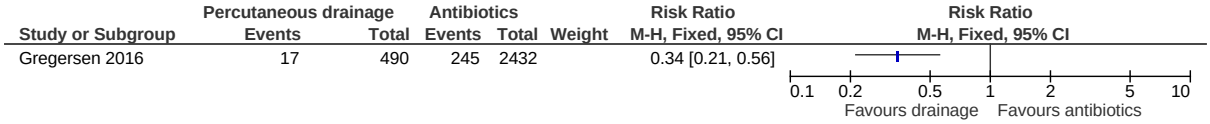


Figure 14: Mortality within 30 days of discharge

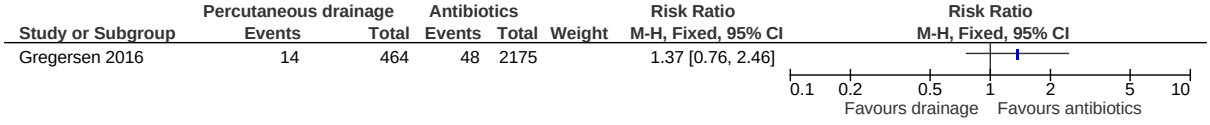


Figure 15: Re-hospitalisation (readmission due to diverticulitis)

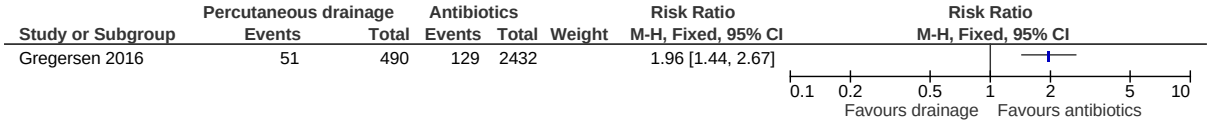
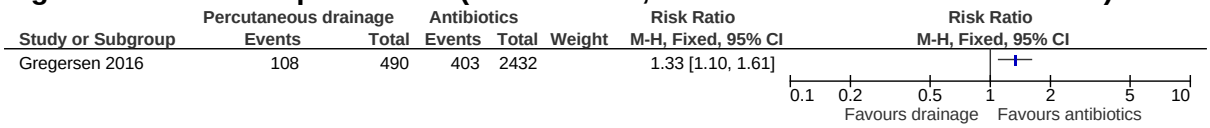


Figure 16: Re-hospitalisation (readmission, reasons other than diverticulitis)



E.6 Percutaneous drainage vs. surgery

Figure 17: Mortality within 30 days of admission

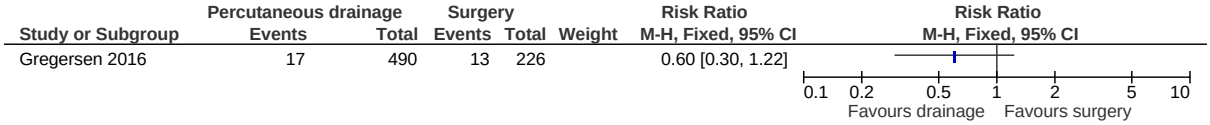


Figure 18: Mortality within 30 days of discharge

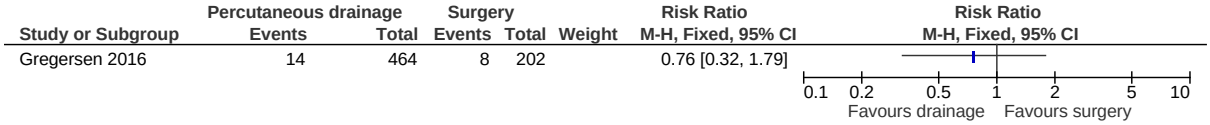


Figure 19: Re-hospitalisation (readmission due to diverticulitis)

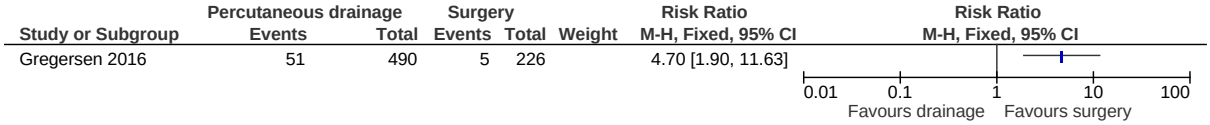
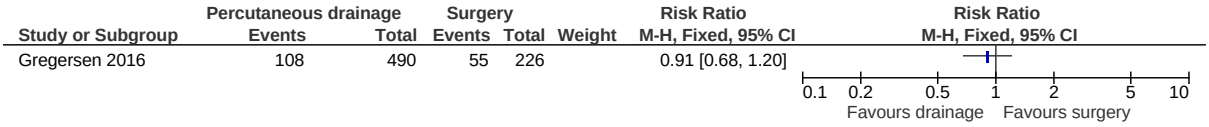


Figure 20: Re-hospitalisation (readmission, reasons other than diverticulitis)



Appendix F: GRADE tables

Table 23: Clinical evidence profile: Antibiotics vs. surgery

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Antibiotics	surgery	Relative (95% CI)	Absolute		
Re-hospitalisation (readmission due to diverticulitis) (follow-up 1-110 months)												
2	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	142/2475 (5.7%)	3.5%	RR 3.11 (1.49 to 6.49)	74 more per 1000 (from 17 more to 192 more)	⊕OOO VERY LOW	CRITICAL
Mortality within 30 days of admission (follow-up mean 30 days)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	245/2432 (10.1%)	5.8%	RR 1.75 (1.02 to 3.01)	44 more per 1000 (from 1 more to 117 more)	⊕OOO VERY LOW	CRITICAL
Mortality within 30 days of discharge (follow-up mean 30 days)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	48/2175 (2.2%)	4%	RR 0.56 (0.27 to 1.16)	18 fewer per 1000 (from 29 fewer to 6 more)	⊕OOO VERY LOW	CRITICAL
Re-hospitalisation (readmission, reasons other than diverticulitis) (follow-up mean 30 days)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	403/2432 (16.6%)	24.3%	RR 0.68 (0.53 to 0.87)	78 fewer per 1000 (from 32 fewer to 114 fewer)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 24: Clinical evidence profile: Percutaneous drainage + antibiotics vs. antibiotics

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Percutaneous drainage + antibiotics	antibiotics	Relative (95% CI)	Absolute		
Re-hospitalisation (readmission due to diverticulitis) (follow-up mean 46-110 months)												
2	observational studies	very serious[1]	serious[2]	no serious indirectness	very serious[3]	none	11/34 (32.4%)	22.6%	RR 1.56 (0.51 to 4.75)	127 more per 1000 (from 111 fewer to 848 more)	⊕OOO VERY LOW	CRITICAL
Need for further surgery/percutaneous drain (follow-up unclear)												
3	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	42/62 (67.7%)	61.3%	OR 1.6 (0.85 to 3.01)	104 more per 1000 (from 39 fewer to 214 more)	⊕OOO VERY LOW	CRITICAL
Stoma creation (follow-up unclear)												
2	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	16/58 (27.6%)	13.6%	RR 1.76 (0.99 to 3.14)	103 more per 1000 (from 1 fewer to 291 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment because the point estimate varies widely between studies and I2=70%. Subgroup analysis could not be performed to explain heterogeneity due to there only being two studies, but the mean age in the two studies differed (≥50 years and <50 years).
[3] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 25: Clinical evidence profile: Percutaneous drainage + antibiotics vs. surgery

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Percutaneous drainage +	surgery	Relative (95% CI)	Absolute		

							antibiotics					
Re-hospitalisation (readmission due to diverticulitis) (follow-up mean 110 months)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	6/22 (27.3%)	4.8%	RR 5.73 (1.26 to 26.05)	227 more per 1000 (from 12 more to 1000 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias

Table 26: Clinical evidence profile: Percutaneous drainage + antibiotics + surgery vs. antibiotics + surgery

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Percutaneous drainage + antibiotics + surgery**	**antibiotics + surgery**	**Relative (95% CI)**	**Absolute**		
Mortality (follow-up unclear)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	3/114 (2.6%)	0%	OR 3.66 (0.23 to 57.57)	30 more per 1000 (from 30 fewer to 80 more)[3]	⊕OOO VERY LOW	CRITICAL
Overall morbidity (follow-up unclear)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	42/114 (36.8%)	34.4%	RR 1.07 (0.63 to 1.83)	24 more per 1000 (from 127 fewer to 286 more)	⊕OOO VERY LOW	CRITICAL
Overall stoma rate (follow-up unclear)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	51/114 (44.7%)	34.4%	RR 1.3 (0.77 to 2.19)	103 more per 1000 (from 79 fewer to 409 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs
[3] Zero events in control group - risk difference entered manually for absolute effect.

Table 27: Clinical evidence profile: Percutaneous drainage vs. antibiotics

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Percutaneous drainage	antibiotics	Relative (95% CI)	Absolute		
Mortality within 30 days of admission (follow-up mean 30 days)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	17/490 (3.5%)	10.1%	RR 0.34 (0.21 to 0.56)	67 fewer per 1000 (from 44 fewer to 80 fewer)	⊕OOO VERY LOW	CRITICAL
Mortality within 30 days of discharge (follow-up mean 30 days)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	14/464 (3%)	2.2%	RR 1.37 (0.76 to 2.46)	8 more per 1000 (from 5 fewer to 32 more)	⊕OOO VERY LOW	CRITICAL
Re-hospitalisation (readmission due to diverticulitis) (follow-up mean 30 days)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	51/490 (10.4%)	5.3%	RR 1.96 (1.44 to 2.67)	51 more per 1000 (from 23 more to 89 more)	⊕OOO VERY LOW	CRITICAL
Re-hospitalisation (readmission, reasons other than diverticulitis) (follow-up mean 30 days)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	108/490 (22%)	16.6%	RR 1.33 (1.1 to 1.61)	55 more per 1000 (from 17 more to 101 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Table 28: Clinical evidence profile: Percutaneous drainage vs. surgery

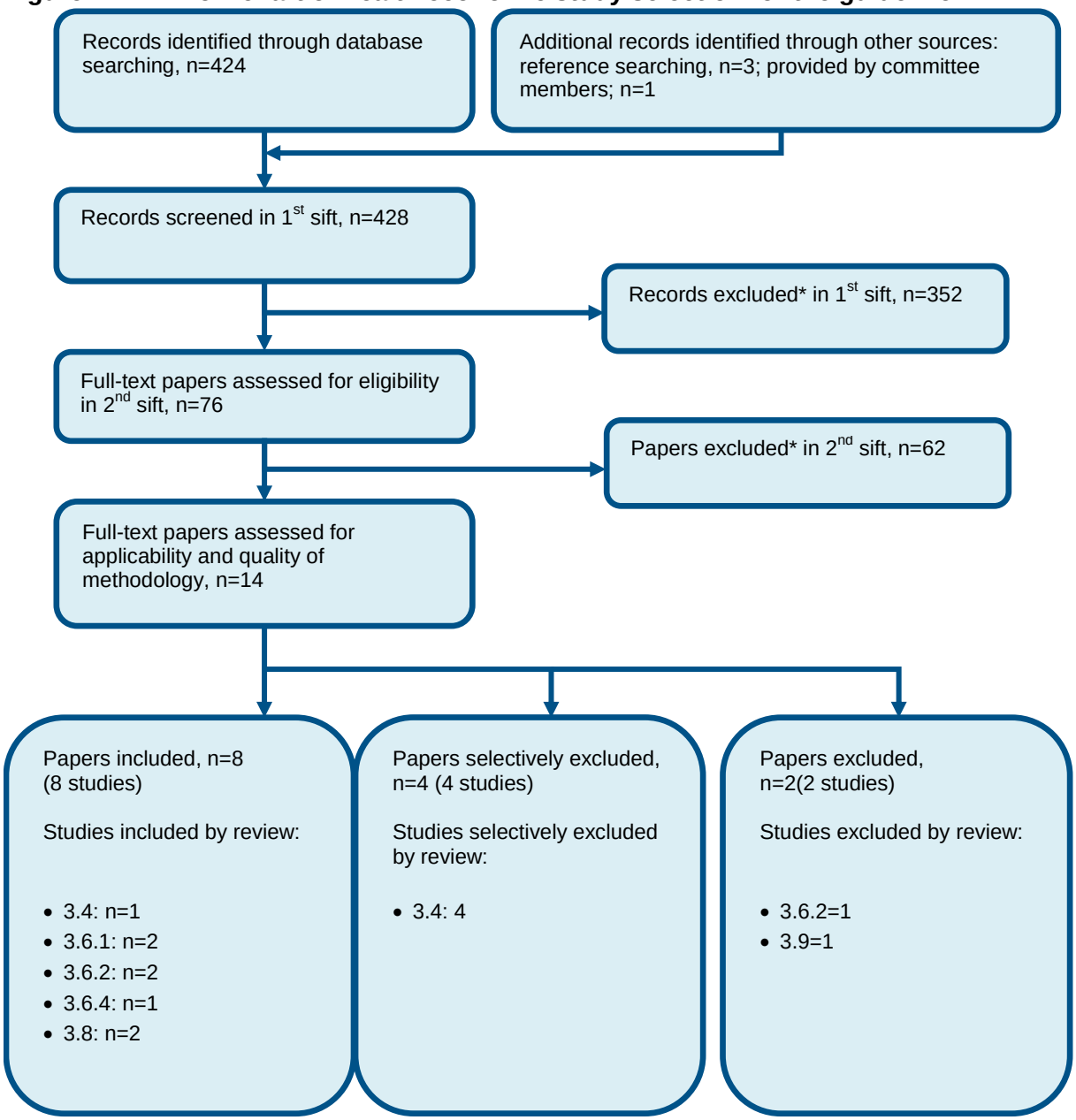
Quality assessment	No of patients	Effect	Quality	Importance

No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Percutaneous drainage**	**surgery**	**Relative (95% CI)**	**Absolute**		
Mortality within 30 days of admission (follow-up mean 30 days)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	17/490 (3.5%)	5.8%	RR 0.6 (0.3 to 1.22)	23 fewer per 1000 (from 41 fewer to 13 more)	⊕OOO VERY LOW	CRITICAL
Mortality within 30 days of discharge (follow-up mean 30 days)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	14/464 (3%)	4%	RR 0.76 (0.32 to 1.79)	10 fewer per 1000 (from 27 fewer to 32 more)	⊕OOO VERY LOW	CRITICAL
Re-hospitalisation (readmission due to diverticulitis) (follow-up mean 30 days)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	51/490 (10.4%)	2.2%	RR 4.7 (1.9 to 11.63)	81 more per 1000 (from 20 more to 234 more)	⊕OOO VERY LOW	CRITICAL
Re-hospitalisation (readmission, reasons other than diverticulitis) (follow-up mean 30 days)												
1	observational studies	very serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	108/490 (22%)	24.3%	RR 0.91 (0.68 to 1.2)	22 fewer per 1000 (from 78 fewer to 49 more)	⊕OOO VERY LOW	CRITICAL

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs

Appendix G: Health economic evidence selection

Figure 21: 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 29: Studies excluded from the clinical review

Study	Exclusion reason
Ambrosetti 1992[1]	Incorrect study design
Bernini 1997[2]	Inappropriate comparison
Dale 2011[4]	Abstract only
Detry 1992[5]	Incorrect interventions
Gaertner 2013[7]	Incorrect outcomes
Galbraith 2017[8]	Not review population. Incorrect interventions
Gregersen 2016[11]	Systematic review: study designs inappropriate
Gregersen 2018[10]	Not review population
Hurme 1995[12]	Not review population
Knapp 2015[14]	Abstract only
Kumar 2006[15]	Incorrect study design
Lamb 2014[16]	Incorrect interventions
Macias 2004[17]	Incorrect study design
Mcdermott 2014[18]	Incorrect study design
Mueller 1987[19]	Not guideline condition. Incorrect study design
Pappalardo 2013[21]	Incorrect study design
Roscoe 2017[22]	Abstract only
Schechter 1994[23]	Not review population. Inappropriate comparison
Shuler 1996[24]	Not review population. Incorrect study design
Suzuki 2015[27]	Not review population. Incorrect study design
Tou 2016[28]	Abstract only
Tudor 1994-1[29]	Incorrect interventions
Villalon 2014[30]	Abstract only