Review

Controversies in Guidelines for the Treatment of Abdominal Abscesses in Acute Diverticulitis: An Umbrella Review

Roberto Cirocchi , Francesca Duro , Stefano Avenia * , Matteo Capitoli , Giovanni Tebala , Massimiliano Allegritti , Bruno Cirillo , Gioia Brachini , Paolo Sapienza , Gian Andrea Binda , Andrea Mingoli , Piergiorgio Fedeli , Riccardo Nascimbeni

Posted Date: 5 July 2023

doi: 10.20944/preprints202307.0269.v1

Keywords: Percutaneous drainage: Diverticular abscess

Review

Controversies in Guidelines for the Treatment of Abdominal Abscesses in Acute Diverticulitis: An Umbrella Review

Roberto Cirocchi [1], Francesca Duro [2], Stefano Avenia *[3], Matteo Capitoli [4], Giovanni Tebala [5], Massimiliano Allegritti [6], Bruno Cirillo [7], Gioia Brachini [8], Paolo Sapienza [9], Gian Andrea Binda [10], Andrea Mingoli [11], Piergiorgio Fedeli [12] and Riccardo Nascimbeni [13]

[1] Department of Medicine and Surgery, S. Maria Hospital, University of Perugia, Terni, Italy. E-mail: roberto.cirocchi@unipg.it.
[2] Department of Medicine and Surgery, S. Maria Hospital, University of Perugia, Terni, Italy. E-mail: durofrancesca3@gmail.com
[3] Department of Medicine and Surgery, S. Maria Hospital, University of Perugia, Terni, Italy. E-mail: stefano_avenia@libero.it.
[4] Department of Medicine and Surgery, S. Maria Hospital, University of Perugia, Terni, Italy. E-mail: matteo.capitoli@studenti.unipg.it
[5] Department of Digestive and Emergency Surgery, AOSP of Terni, Italy. E-mail: gianni.tebala@aospterni.it.
[6] Department of Radiology, AOSP of Terni, Italy. E-mail: m.allegretti@aospterni.it
[7] Emergency Department, Policlinico Umberto I, Sapienza University, Rome, Italy. E-mail: bruno.cillo@uniroma1.it
[8] Emergency Department, Policlinico Umberto I, Sapienza University, Rome, Italy. E-mail: gioia.brachini@uniroma1.it.
[9] Emergency Department, Policlinico Umberto I, Sapienza University, Italy. E-mail: paolo.sapienza@uniroma1.it.
[10] General Surgery, Biomedical Institute, 16152 Genoa, Italy, gianbinda1@gmail.com
[11] Emergency Department, Policlinico Umberto I, Sapienza University, Rome, Italy. E-mail: andrea.mingoli@uniroma1.it.
[12] Shool of Law, University of Camerino, 62032 Camerino, Italy, piergiorgio.fedeli@unicam.it
[13] Department of Molecular and Translational Medicine, University of Brescia, 25121 Brescia, Italy. riccardo.nascimbeni@unibs.it
* Correspondence: Author: Roberto Cirocchi, Department of Medicine and Surgery, S. Maria Hospital, University of Perugia, Terni, Italy. E-mail: roberto.cirocchi@unipg.it. Tel: 3492170096. .

Abstract: Background: This systematic umbrella review aims to investigate whether provide an analysis of guidelines regarding the treatment of diverticular abscesses summarizing the evidences from the best available practice. Material and methods: A systematic literature search was performed until using the Cochrane Overviews of Reviews model for search the 'Clinical Practice Guidelines'; at the end of initial search only 12 guidelines, whose characteristics are reported in the following table were included in this analysis. The quality of the guidelines was assessed by adopting the 2017 updated version of the "Appraisal of Guidelines for Research and Evaluation II" (AGREE II). The comparative analysis of these guidelines has highlighted the presence of some differences regarding the recommendations on the treatment of diverticular abscesses. In particular, there are some controversies about the diameter of abscess to be used in order to decide between medical treatment and percutaneous drainage. Different guidelines propose different abscess diameter cutoffs, such as 3 cm, 4-5 cm, or 4 cm, for distinguishing between small and large abscesses. Conclusions: Currently, a lot of scientific societies recommend that diverticular abscesses with diameters larger than 3 cm should be considered for percutaneous drainage whereas abscesses with diameters smaller than 3 cm could be appropriately treated by medical therapy with antibiotics; only, few guidelines, suggest the use of percutaneous drainage for abscess with a diameter greater than 4 cm .The difference among guidelines is the consequence of the different selection of scientific evidences. In conclusion, our evaluation has revealed the importance of seeking new scientific evidence with higher quality to either confirm, reinforce or potentially weaken the existing recommendations from different societies.

 doi:10.20944/preprints202307.0269.v1

Keywords: percutaneous drainage: diverticular abscess

1. Introduction

Guidelines are very important in daily clinical practice and are indeed the basis of surgical protocols. Their use – or misuse – has consequences not only in health-care. For instance, "clinical practice guidelines" (CPGs), have a dual role in malpractice litigation: defensive (exculpatory evidence) or accusatory (inculpatory evidence). In absence of evidence ("balance of probabilities" or "preponderance of evidence"), the claim is based only in the different opinions of experts).

In recent years, several guidelines on the treatment of acute complicated diverticulitis of the colon have been published by different scientific societies. Sometimes, however, the recommendations for the management of abdominal abscesses, in particular, are conflicting. This may be due to the different literature evidence used in the guidelines. Moreover, most of these evidence are low-level.

The goal of this review is to provide an analysis of guidelines regarding the treatment of diverticular abscesses [1] summarizing the evidences from the best available practice.

2. Materials and Methods

We use the Cochrane Overviews of Reviews model [1] for search the '*Clinical Practice Guidelines*' in on PubMed, SCOPUS and on Web of Science, National Institute for Health and Care Excellence (NICE), Scottish Intercollegiate Guidelines Network (SIGN), Guidelines International Network (GIN), Cochrane Library, PubMed, Embase, and American College of Chest Physicians (ACCP).

The following search strategy was carried out using the following keywords: "guideline", "best practice", "recommendations", "consensus", "acute diverticulitis", "acute colonic diverticulitis", in various combinations with the Boolean operators and, or, and not.

The search for relevant studies was performed from January 2010 to April 2023. The checklist of PRISMA-ScR (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews) was followed [2].

The PubMed function "related articles" was used to extend the search. We also performed hand-search of bibliography of included studies, to identify further potentially eligible investigations.

Inclusion criteria were all type of guidelines about the management of abdominal abscess from acute colonic diverticulitis. Language restriction was applied at only english language.

All studies were independently assessed for eligibility by two reviewers (RC and MM), and eventual controversies were resolved by a consensus among the reviewers.

The following data were independently extracted from included guidelines: first author name, scientific society promoted, country, year of publication, statement, consensus levels of agreement.

The quality of the guidelines was assessed by adopting the 2017 updated version of the "Appraisal of Guidelines for Research and Evaluation II" (AGREE II) [3]

A total of 23 items divided into 6 dimensions were analyzed for each guideline.

These 6 dimensions are as follows:

1. General objectives and areas of application
2. Involvement of stakeholders
3. Methodological rigor
4. Expository clarity
5. The applicability
6. Editorial independence

Each item was rated on a scale from 1 (strongly disagree) to 7 points (strongly agree). The score of each dimension is equal to the score of the various items contained in each dimension, calculated as a percentage according to the formula:

(Score achieved – lowest possible score)/ (Highest possible score – lowest possible score)X100

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 July 2023 doi:10.20944/preprints202307.0269.v1

Based on the results obtained, a recommendation level A (strong recommendation) was assigned if all dimensions scored above 60%, or recommendation level B (weak recommendation) if at least one dimension scored below 60 %.

3. Results

At the end of initial search of titles and abstracts, 22 full text were screened for relevance; only 12 guidelines [4–24], whose characteristics are reported in the following table (Table 1) were included in this analysis.

Table 1. Guidelines included.

Guideline		Data of publication	Previous editions	Authors
American College of Physicians	ACP	2022 (Qaseem[4])		Standards committee
German Societies for Gastroenterology and Visceral Surgery	DGVS DGAV	2022 (Kruis [5,6])	2014 (Kruis [7])	Expert panel
European Society of Coloproctology	ESCP	2020 (Schultz[8])		Consensus meeting
World Society of Emergency Surgery	WSES	2020 (Sartelli[9])	2016 (Sartelli [10]), 2011 (Sartelli[11])	Expert panel
American Society of Colon and Rectal Surgeons	ASCRS	2020 (Hall[16])	2014 (Feingold[15]), 2006 (Rafferty[14]), 2000 (Wong[13]), 1995 (Roberts[12])	Standards committee
The National Institute for Health and Care Excellence	NICE	2019 (NICE[24])		Standards committee
Gastrointestinal and Endoscopic Surgeons	SAGES	2018 (Francis[17])		Consensus meeting
European Association for Endoscopic Surgery	EAES		2009 (Köhler[18])	Consensus meeting
Polish Society of Gastroenterology and the Association of Polish Surgeons	PSG TChP	2015 (Pietrzak[19])		Expert panel
Italian Society of Colon and Rectal Surgery	SICCR	2015 (Binda[20])		Expert panel
Italian Study Group of Diverticular Disease	GRIMAD	2014 (Cuomo[21])		Consensus meeting
Netherlands Society of Surgery	NTVG	2013 (Andeweg[22])		Expert panel
Danish Surgical Society	DKS	2012 (Andersen[23])		Expert panel

The remaining 10 guidelines were excluded for the following reasons:

The topic of guidelines is diverticular disease, but the Authors do not report the treatment of abscess (3 articles) [25–27].

The guidelines were not written in english language (5 articles) [28–32].

The guidelines were excluded for the analysis performed only on a subgroup of patients (2 articles) [33,34].

According to specific criteria: evalutation of guidelines' quality with AGREE II instrument. [35].

According to the adopted criteria, seven guidelines reach a strong (Level A) recommendation (Kruis [5,6], Schultz [8], Sartelli [9], Hall [16], NICE [24], Francis [17], Cuomo [21]) (SDC 1) whereas

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 July 2023 doi:10.20944/preprints202307.0269.v1

five guidelines reach a weak (Level B) recommendation (Qaseem [4], Pietrzak [19], Binda [20], Andeweg [22], Andersen [23]) (SDC 2).

Focusing on quality of each of the 6 dimensions according to the adopted score:

- Dimension 1 - General objectives and areas of application (item 1-3): all guidelines were high quality, totaling a percentage higher than 60% (SDC 3).
- Dimension 2 - Involvement of stakeholders (item 4-6): most guidelines, except those of Binda [20] with 33.3% and Andeweg [22] with 44.4%, totaled a score above 60% (SDC 4).
- Dimension 3 - Methodological rigor (item 7-14): all guidelines but that of Pietrzak[19] with 41.6%, scored higher than 60% (SDC 5)
- Dimension 4 - Expository clarity by language, structure and format (item 18-21): all except one guideline (Qaseem with 45.8%)[4] scored more than 60% (SDC 6).
- Dimension 5 - the applicability by analyzing the possible barriers and factors facilitating the implementation of the guideline, the possible strategies to favor its adoption, the implication on the economic resources resulting from the application of the guideline (items 18-21); eight guidelines (Kruis [5,6], Schultz [8], Sartelli [9], Hall [16], NICE [24], Francis [17], Cuomo [21], Andeweg [22]) reached a high level of quality, totaling scores above 60% whereas the remainders (Qaseem [4], Pietrzak [19], Binda [20], Andersen [23]) achieved a weak level of recommendation, scoring below 60% (SDC 7).
- Dimension 6 - Editorial independence (Items 22-23): most guidelines, except those of Pietrzak [19], Binda [20], Andeweg [22] and Andersen [23], achieved a good level of recommendation, scoring above 60% (SDC 8).

In the table we find the extended results of the evaluation (SDC 19).

3.1. Analysis of conflicting recommendations

The comparative analysis of these guidelines has highlighted the presence of some differences regarding the recommendations on the treatment of diverticular abscesses. In particular, there are some controversies about the diameter of abscess to be used in order to decide between medical treatment and percutaneous drainage (Table 2).

Table 2. Lower diameter of abscess in patients underwent percutaneous drainage.

Not reported a diameter	Diverticular abdominal abscess (diameter > 3 cm)	Diverticular abdominal abscess (diameter > 3-4 cm)	Diverticular abdominal abscess (diameter > 4 cm)	Diverticular abdominal abscess (diameter > 4-5 cm)
DKS 2012 (Andersen[23]) EAES 2009 (Köhler[18]) ASCRS 2006 (Rafferty[14]) ASCRS 2000 (Wong[13]) ASCRS 1995 (Roberts[12])	DGVS and DGAV 2022 (Kruis[5,6]) ASCRS 2020 (Hall[16]) ESCP 2020 (Schultz[8]) NICE 2019 (NICE[24]) PSG and TChP 2015 (Pietrzak[19])	ASCRS 2014 (Feingold[15])	EAES and SAGES 2018 (Francis[17]) SICCR 2015 (Binda[20]) GRIMAD 2014 (Cuomo[21]) WSES 2011 (Sartelli[11]) DGVS and DGAV 2014 (Kruis[7])	WSES 2020 (Sartelli[9]) WSES 2016 (Sartelli[10]) NTVG 2013 (Andeweg[22])

A cut-off above which to perform percutaneous drainage was not defined in seven Guidelines, four of these Guidelines are previous versions of the ASCRS [12–15] and one is an earlier version of the EAES [18].

This diameter was standardized in four groups, in two of which there was an overlapping:

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 July 2023 doi:10.20944/preprints202307.0269.v1

Less than 3 cm
between 3-4 cm
less than 4 cm
between 4-5 cm

Currently, most scientific societies (DGVS [5] and DGAV [6], ASCRS [16], ESCP [8], NICE [24], PSG and TChP [19]) recommend that diverticular abscesses with diameters larger than 3 cm should be considered for percutaneous drainage whereas abscesses with diameters smaller than 3 cm could be appropriately treated by medical therapy with antibiotics, only.

Differently, other guidelines, suggest the use of percutaneous drainage for abscess with a diameter greater than 4 cm (EAES and SAGES 2018) [17] and 5 cm (SICCR 2015) [20].

The difference among guidelines is the consequence of the different selection of scientific evidences.

The ESCP 2020 [36,37] recommendations, based on a systematic reviews and a multicentre study, suggest performing percutaneous drainage in abscesses larger than 3 cm in diameter [36,37].

ESCP 2020 [36,37]	*"Although the role of percutaneous drainage of abscesses in acute diverticulitis is not completely clear, it may be considered in patients with an abscess larger than 3 cm. Emergency surgery should be kept as last resort for patients failing other nonsurgical treatments"*

Also the LG DGVS/DGAV 2022 supports this recommendation [29,38]:

DGVS and DGAV 2022 [38,39]	*"To distinguish between micro and macro abscesses, a threshold value of approximately 3 cm can be applied, since this reflects the possibility of interventional drainage and the risk of recurrence correlates with the size of the abscess"*
	"Larger retroperitoneal or paracolic abscesses (> 3cm) can be interventionally drained (sonography, CT)"

This opinion is also the one reported in the ASCRS 2020 Guidelines, which are based on two prospective studies [38,39].

ASCRS 2020 [38,39]	*"Image-guided percutaneous drainage is usually recommended for stable patients with abscesses >3 cm in size"*
	"Evidence level moderate-quality evidence 1B, recommendation grade: strong recommendation"

Finally, we should highlight that even the NICE guidelines, based on 5 studies, suggest performing percutaneous drainage in abscesses with a diameter > 3 cm.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 July 2023 doi:10.20944/preprints202307.0269.v1

NICE 2019 [40–44]	*"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 or if there is deterioration."*

Currently only the guidelines of the EAES and SEGES 2018 [17] suggest percutaneous drainage in abscess with a diameter greater than 4 cm.

In identifying the abscess' diameter, these guidelines are largely based on systematic reviewes by Gregersen and on another study [45–47].

In conclusion only WSES 2020, based on 5 studies, reported a major cut-off of 4-5 cm as lower abscess diameter for percutaneous drainage [48–52].

WSES 2020 [48–52]	*"For patients with a small (< 4–5 cm) diverticular abscess, we suggest an initial trial of non-operative treatment with antibiotics alone (weak recommendation based on low-quality evidence, 2C).* *We suggest to treat patients with large abscesses with percutaneous drainage combined with antibiotic treatment; whenever percutaneous drainage of the abscess is not feasible or not available, we suggest to initially treat patients with large abscesses with antibiotic therapy alone, clinical conditions permitting. Alternatively, an operative intervention is required"*

3.2. Historical view

Most of the previous guidelines suggested the possibility of performing percutaneous drainage but did not define the dimensions of the abscess that could be drained and sometimes also the advantages.

Previous guidelines ASCRS 2006 (based on one study), ASCRS 2000 (based on expert opinion) and ASCRS 1995 (based on expert opinion) suggested performing percutaneous drainage in large diverticular abscesses but did not identify reference diameters [53].

ASCRS 2006 [53]	*"Radiologically guided percutaneous drainage is usually the most appropriate treatment for patients with a large diverticular abscess."*
ASCRS 2000 [53]	*"For a patient with a large diverticular abscess, two options are available, percutaneous or surgical drainage. The potential advantage of percutaneous drainage is that it may allow stabilization of the patient and avoidance of a temporary stoma and a second operation. Drainage*

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 July 2023 doi:10.20944/preprints202307.0269.v1

	of radiologically accessible unilocular collections may allow temporary defervescence before resection with primary anastomosis."
ASCRS 1995 [53]	*"For a patient with a large diverticular abscess that does not resolve with medical treatment two options are available, percutaneous or surgical drainage. The potential advantage of percutaneous drainage is stabilization of the patient and avoidance of a temporary stoma. Unilocular collections with a radiologic "window" for drainage allow temporary palliation before resection with primary anastomosis."*

In the EAES 2009 [54] guidelines, based on one study, and then in the DKS 2012 [55–57] guidelines, based on 4 studies, percutaneous drainage was generically suggested for both mesenteric and pelvic abscesses

EAES 2009 [55–57]	*"Hinchey I (abscess confined to mesentery) should first be treated by percutaneous drainage where possible, followed by sigmoid colectomy and primary anastomosis in fit patients (consensus)".*
	"Hinchey II (pelvic abscess, whatever the localization) should also be treated by percutaneous drainage, and followed later by sigmoid resection in most cases, but the risk in patients with comorbidity must be considered in the final decision (consensus)".

Guidelines PSG/TChP 2015, based on two studies, recommend percutaneous drainage in abscesses with a minimum diameter of 3 cm [58–60].

PSG and TChP 2015 [58–60]	*"Abscesses < 3 cm may be treated with antibiotics only, provided that the patient is continuously monitored. If technically feasible, abscesses > 3 cm should be treated with antibiotics and USG/CT-guided percutaneous drainage."*

On the other hand, the ASCRS 2014 guidelines, based on 4 studies, suggested performing percutaneous drainage in abscesses with a minimum diameter between 3-4 cm [61–64].

ASCRS 2014 [61–64]	*"Deciding which patients with diverticular abscesses require percutaneous drainage rather than medical management, and which patients should undergo definitive surgery after successful abscess treatment (with or without percutaneous drainage), remains controversial. Several studies support medical treatment without*

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 July 2023 doi:10.20944/preprints202307.0269.v1

	percutaneous drainage for clinically stable patients with small abscesses up to 3 to 4 cm in the largest dimension, recognizing that many of these abscesses will resolve without a drainage procedure. However, patients who do not clinically improve without drainage should undergo percutaneous drain placement".

In the past, the previous guidelines of the DGVS and DGAV 2014, based on five studies, indicated percutaneous drainage only in abscesses with a diameter > 4 cm [65–69].

DGVS and DGAV 2014 [65–69]	*"Retroperitoneal or paracolic abscesses can be drained interventionally (US, CT). In the case of small abscesses that cannot be punctured safely, conservative treatment alone should be undertaken with daily monitoring of clinical symptoms and inflammation parameters (CRP, leukocytes). Strong consensus; recommendation"*

Even the not recent Italian guidelines produced by SICCR (based on 3 studies) [70–72], GRIMAD [73–75] (based on 3 studies) and international guidelines produced by WSES [76–78] (based on 3 studies) suggest performing percutaneous drainage in case of abscesses with a diameter > 4 cm.

SICCR 2015 [70–72]	*"What are the treatment options for diverticular abscess? We recommend the guided percutaneous drainage combined with antibiotics as the preferable treatment for >4 cm diverticular abscesses. Those abscesses not responding to or not amenable to non-operative management should be treated surgically"*

GRIMAD 2014 [73–75]	*"The best treatment option for a diverticular abscess >4 cm in diameter is percutaneous guided drainage. Diverticular abscesses not responding, or not amenable, to non-operative management should be treated surgically."*

WSES 2011 [76–78]	*"Systemic antibiotic treatment alone is usually the most appropriate treatment for patients with a small (<4 cm in diameter) diverticular abscess and image guided percutaneous drainage is for those with a large (>4 cm in diameter)"*

Previously the WSES [79–83] based on five studies, and NTVG [84–88], based on five studies, reported the recommendation of the cut-off of 4-5 cm as lower abscess diameter for percutaneous diameter.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 July 2023 doi:10.20944/preprints202307.0269.v1

WSES 2016 [79–83]	*"Patients with large abscesses (>4–5 cm) can best be treated by percutaneous drainage combined with antibiotic treatment."*

NTVG 2013 [84–88]	*"Smaller abscesses (<4–5 cm) can be treated with antibiotics alone, whereas larger abscesses can best be treated with percutaneous drainage combined with antibiotic treatment (level 3)."*

3.3. Analysis of the degree of overlap in the studies on which the guidelines are based

To determine overlap between guidelines, 'citation matrices' were generated (Table 3). In the WSES guidelines (60%) there is the greatest overlap of the studies included, followed by those of ASCRS 2020 (50%) and EAES/SAGES 2018 50% compared to the other guidelines (NICE 2019 33.3%, DVGS/DGAV 2022 0%).

	DGVS and DGAV 2022	**WSES 2020**	**ESCP 2020**	**ASCRS 2020**	**NICE 2019**	**EAES and SAGES 2018**
Gregersen 2018			X			
Lambrichts 2019			X			
Buchwald 2017					X	
Gregersen 2016					X	X
Lamb 2014	X					
Subhas 2014					X	
Singh 2008		X				
Siewert 2006		X			X	
Brandt 2006		X		X	X	
Kumar 2006		X				X
Ambrosetti 2006		X				
Kaiser 2005					X	
Elagili 2005				X		
Total	0/1	3/5 (60%)	0/2	1/2 (50%)	2/6 (33.3%)	1/2 (50%)

Some guidelines (DVGS/DGAV 2022, NICE 2019 and EAES/SAGES 2018) contained systematic reviews, so we performed a subsequent analysis of the degree of overlap of the studies on which the included systematic reviews were based (Table 4).

	Fowler 2021	**Lee 2020**	**Gregersen 2016**	**Lamb 2014**
Aquina 2019	X	X		
Lambrichts 2017	X	X		
Gregersen 2018	X			
You 2018	X	X		
Buchwald 2017	X			
Jalouta 2017	X	X		
Titos-Garcia 2017		X		
Gregersen 2016				
Devaraj 2016	X			
Garfinkle 2016	X	X		
Occhionorelli 2016	X			

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 July 2023 doi:10.20944/preprints202307.0269.v1

Rose 2015			X	
Elagili 2015	X		X	
Trenti 2015	X	X	X	
Subhas 2014	X	X	X	
Sallinen 2014		X	X	
Li 2014			X	
Edna 2014	X			
Elagili 2014		X	X	X
Pappalardo 2013	X		X	
Felder 2013	X	X	X	X
Gaetner 2013	X	X	X	X
Van Der Wall 2013	X	X	X	X
Ambrosetti 2012			X	
Levack 2012			X	
Hall 2011			X	
Dharmarajan 2011	X	X	X	X
Park 2010	X			
Etzioni 2010	X		X	
Eglinton 2010	X		X	
Nelson 2008	X			
Singh 2008	X	X	X	X
Pautrat 2007	X	X		X
Alvarez 2007	X	X		X
Siewert 2006	X		X	X
Kumar 2006	X		X	
Brandt 2006	X	X	X	X
Durmishi 2006			X	X
Kaiser 2005	X		X	X
Ambrosetti 2005	X	X	X	X
Broderick-Villa 2005			X	
Macias 2004	X	X	X	X
Poletti 2007	X		X	
Harisinghani 2003	X		X	
Bahadursingh 2003	X	X		X
Ambrosetti 2002			X	
Bernini 1997			X	
Sher 1997			X	
Belmonte 1996				X
Schechter 1994	X		X	
Tudor 1994			X	
Detry 1992	X		X	
Lambiase 1992	X		X	
Hachigian 1992	X	X		X
Ambrosetti 1992				X
Smirniotis 1991			X	
Stabile 1990	X	X		X
Mueller 1987			X	X
Neff 1987			X	X
Saini 1986	X			X
Auguste 1985			X	

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 July 2023 doi:10.20944/preprints202307.0269.v1

Alexander 1983			X	
Total	20/41 (48.71%)	22/23 (95,65%)	22/42 (53.38%)	15/22 (68.1%)

The two systematic reviews (Gregersen and Lamb) included in the guidelines were the first to be published (2016 - 2014) and included 42 and 22 studies respectively; Gregersen's review had a study overlap of 53.65%, while Lamb's had a greater overlap (68.1%). The two most recent systematic reviews did not include a number of higher studies (41 in Fowler 2021, 22 in Lee 2020), but in Lee's rate of overlap of studies was higher than in previous ones. From this it follows that the guidelines that contained the two systematic reviews (NICE, EAES and SAGES, DVGS/DGAV) are based on a higher overlap rate of the studies included.

4. Discussion

The current management of diverticular abscesses requires a multidisciplinary approach involving infectious disease specialists, interventional radiologists and surgeons.

The therapeutic decisions are based on CT scan results, which provide accurate information about the size and location of the abscesses and help determine the appropriate treatment approach.

For small sized diverticular abscesses, intravenous antibiotic therapy is recommended. On the other hand, larger abscess may require percutaneous drainage if anatomically accessible.

Surgery is reserved for cases where percutaneous drainage fails or for large abscesses that cannot be accessed through percutaneous drainage and are unresponsive to antibiotic therapy.

However, there is controversy among different guidelines regarding the cut-off diameter for abscesses that require percutaneous drainage. In fact the definition of "'small" and "large" abscesses varies among the guidelines, leading to inconsistent recommendations [89].

For example, one of the most recent guidelines, from the German Societies for Gastroenterology and Visceral Surgery (DGVS/DGAV), identifies a diameter of 3 cm as the value for distinguishing between micro and macro abscesses [94]. This cut-off is also shared by other societies, such as the ASCRS (American Society of Colon and Rectal Surgeons) [95] and NICE (National Institute for Health and Care Excellence) [96]. However, differing from these is the World Society of Emergency Surgery (WSES), which reported a cut-off of 4-5 cm [97].

Some studies, including one by Lambrichts, have shown worse outcomes for patients who for patients who underwent percutaneous drainage compared to those who received medical therapy alone. These results may be influenced by selection bias, as patients in worse general conditions are more likely to be enrolled in the percutaneous drainage [90,91].

Another study conducted by Elagili et al. sought to evaluate the difference between treatment with antibiotic therapy alone and percutaneous drainage in abscesses of diameter larger than 3cm. This showed that selected patients could be treated initially with antibiotics alone without any negative consequences on their outcomes [99].

However, a retrospective analysis conducted by Buchwald et al. on patients admitted to Christchurch Hospital evaluated the long-term outcomes of conservative treatment in diverticular abscesses (Hinchey I and II). It was found that the number of recurrences was higher in patients who were treated with initial conservative treatment (antibiotics +/- percutaneous drainage) than in those who underwent surgery [100].

The NICE guidelines suggest considering percutaneous drainage only for abscesses larger than 3 cm due to technical difficulties in performing the procedure on smaller abscesses [92].

However, these guidelines acknowledge that the evidence supporting this recommendation is of very low quality due to selection bias and other limitations.

Meta-analyses reported by NICE have evaluated outcomes without stratifying patients based on different abscess diameters [41,44] Therefore, there is a need for new large studies to determine the appropriate diameter cutoff for percutaneous drainage.

5. Conclusion

The treatment of abdominal abscesses in patients with acute colonic diverticulitis is a significant therapeutic challenge. The approach has shifted from surgical intervention to non-surgical, minimally invasive management over the years. This change is attributed to advancements in technology, improved intensive care monitoring, the use of computed axial tomography, and the introduction of minimally invasive techniques such as percutaneous eco/CT-guided drainage.

Various national and international societies have attempted to provide treatment recommendations, but there are conflicting opinions, especially regarding the abscess cutoff diameter for intervention. Guidelines often have a low degree of recommendation due to the low quality of evidence, primarily stemming from selection bias and imprecision.

Different guidelines propose different abscess diameter cutoffs, such as 3 cm, 4-5 cm, or 4 cm, for distinguishing between small and large abscesses. Generally, small abscesses are recommended for medical antibiotic therapy, while larger abscesses may require percutaneous drainage, with or without antibiotic therapy.

In conclusion, our evaluation has revealed the importance of seeking new scientific evidence with higher quality to either confirm, reinforce or potentially weaken the existing recommendations from different societies.

This pursuit will undoubtedly result in more accurate and shared recommendations, which can resolve the controversies in various guidelines. Most importantly, it can lead to improved treatment outcomes for patients with abdominal abscess from acute colonic diverticulitis.

Author Contributions: All authors substantially contributed to the manuscript. All authors read and approved the final version of the manuscript.

Funding: No funding was received for the present study.

Acknowledgments: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

For this clinical case, no ethics commission has met.

References

1. Pollock M, Fernandes RM, Becker LA, Pieper D, Hartling L. Chapter V: Overviews of Reviews. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.
2. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, Moher D, Peters MDJ, Horsley T, Weeks L, Hempel S, Akl EA, Chang C, McGowan J, Stewart L, Hartling L, Aldcroft A, Wilson MG, Garritty C, Lewin S, Godfrey CM, Macdonald MT, Langlois EV, Soares-Weiser K, Moriarty J, Clifford T, Tunçalp Ö, Straus SE. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. Ann Intern Med 2018, 169:467-473
3. Brouwers MC, Kho ME, Browman GP, Burgers JS, Cluzeau F, Feder G, Fervers B, Graham ID, Grimshaw J, Hanna SE, Littlejohns P, Makarski J, Zitzelsberger L; AGREE Next Steps Consortium. AGREE II: advancing guideline development, reporting and evaluation in health care. CMAJ. 2010 Dec 14;182(18):E839-42.
4. Qaseem A, Etxeandia-Ikobaltzeta I, Lin JS, Fitterman N, Shamliyan T, Wilt TJ; Clinical Guidelines Committee of the American College of Physicians*; Crandall CJ, Cooney TG, Cross JT Jr, Hicks LA, Maroto M, Mustafa RA, Obley AJ, Owens DK, Tice J, Williams JW Jr; Clinical Guidelines Committee of the American College of Physicians. Diagnosis and Management of Acute Left-Sided Colonic Diverticulitis: A Clinical Guideline From the American College of Physicians. Ann Intern Med. 2022 Mar;175(3):399-415.
5. Kruis W, Germer CT, Böhm S, Dumoulin FL, Frieling T, Hampe J, Keller J, Kreis ME, Meining A, Labenz J, Lock JF, Ritz JP, Schreyer A, Leifeld L; German Society of Gastroenterology, Digestive and Metabolic Diseases (DGVS) and the German Society of General and Visceral Surgery (DGAV) (AWMF-Register 021-20). German guideline diverticular disease/diverticulitis: Part I: Methods, pathogenesis, epidemiology, clinical characteristics (definitions), natural course, diagnosis and classification. United European

Gastroenterol J. 2022 Nov;10(9):923-939. doi: 10.1002/ueg2.12309. Epub 2022 Nov 21. PMID: 36411504; PMCID: PMC9731664.

6. Kruis W, Germer CT, Böhm S, Dumoulin FL, Frieling T, Hampe J, Keller J, Kreis ME, Meining A, Labenz J, Lock JF, Ritz JP, Schreyer AG, Leifeld L; German Society of Gastroenterology, Digestive and Metabolic Diseases (DGVS) and the German Society of General and Visceral Surgery (DGAV) (AWMF-Register 021-20). German guideline diverticular disease/diverticulitis: Part II: Conservative, interventional and surgical management. United European Gastroenterol J. 2022 Nov;10(9):940-957. doi: 10.1002/ueg2.12313. Epub 2022 Dec 2. PMID: 36459576; PMCID: PMC9731665.
7. Kruis W, Germer CT, Leifeld L; German Society for Gastroenterology, Digestive and Metabolic Diseases and The German Society for General and Visceral Surgery. Diverticular disease: guidelines of the german society for gastroenterology, digestive and metabolic diseases and the german society for general and visceral surgery. Digestion. 2014;90(3):190-207. doi: 10.1159/000367625. Epub 2014 Nov 19. PMID: 25413249.
8. Schultz JK, Azhar N, Binda GA, Barbara G, Biondo S, Boermeester MA, Chabok A, Consten ECJ, van Dijk ST, Johanssen A, Kruis W, Lambrichts D, Post S, Ris F, Rockall TA, Samuelsson A, Di Saverio S, Tartaglia D, Thorisson A, Winter DC, Bemelman W, Angenete E. European Society of Coloproctology: guidelines for the management of diverticular disease of the colon. Colorectal Dis. 2020 Sep;22 Suppl 2:5-28. doi: 10.1111/codi.15140. Epub 2020 Jul 7. PMID: 32638537.
9. Sartelli M, Weber DG, Kluger Y, Ansaloni L, Coccolini F, Abu-Zidan F, Augustin G, Ben-Ishay O, Biffl WL, Bouliaris K, Catena R, Ceresoli M, Chiara O, Chiarugi M, Coimbra R, Cortese F, Cui Y, Damaskos D, De' Angelis GL, Delibegovic S, Demetrashvili Z, De Simone B, Di Marzo F, Di Saverio S, Duane TM, Faro MP, Fraga GP, Gkiokas G, Gomes CA, Hardcastle TC, Hecker A, Karamarkovic A, Kashuk J, Khokha V, Kirkpatrick AW, Kok KYY, Inaba K, Isik A, Labricciosa FM, Latifi R, Leppäniemi A, Litvin A, Mazuski JE, Maier RV, Marwah S, McFarlane M, Moore EE, Moore FA, Negoi I, Pagani L, Rasa K, Rubio-Perez I, Sakakushev B, Sato N, Sganga G, Siquini W, Tarasconi A, Tolonen M, Ulrych J, Zachariah SK, Catena F. 2020 update of the WSES guidelines for the management of acute colonic diverticulitis in the emergency setting. World J Emerg Surg. 2020 May 7;15(1):32. doi: 10.1186/s13017-020-00313-4. PMID: 32381121; PMCID: PMC7206757.
10. Sartelli M, Catena F, Ansaloni L, Coccolini F, Griffiths EA, Abu-Zidan FM, Di Saverio S, Ulrych J, Kluger Y, Ben-Ishay O, Moore FA, Ivatury RR, Coimbra R, Peitzman AB, Leppaniemi A, Fraga GP, Maier RV, Chiara O, Kashuk J, Sakakushev B, Weber DG, Latifi R, Biffl W, Bala M, Karamarkovic A, Inaba K, Ordonez CA, Hecker A, Augustin G, Demetrashvili Z, Melo RB, Marwah S, Zachariah SK, Shelat VG, McFarlane M, Rems M, Gomes CA, Faro MP, Júnior GA, Negoi I, Cui Y, Sato N, Vereczkei A, Bellanova G, Birindelli A, Di Carlo I, Kok KY, Gachabayov M, Gkiokas G, Bouliaris K, Çolak E, Isik A, Rios-Cruz D, Soto R, Moore EE. WSES Guidelines for the management of acute left sided colonic diverticulitis in the emergency setting. World J Emerg Surg. 2016 Jul 29;11:37. doi: 10.1186/s13017-016-0095-0. PMID: 27478494; PMCID: PMC4966807.
11. Sartelli M, Viale P, Koike K, Pea F, Tumietto F, van Goor H, Guercioni G, Nespoli A, Tranà C, Catena F, Ansaloni L, Leppaniemi A, Biffl W, Moore FA, Poggetti R, Pinna AD, Moore EE. WSES consensus conference: Guidelines for first-line management of intra-abdominal infections. World J Emerg Surg. 2011 Jan 13;6:2. doi: 10.1186/1749-7922-6-2. PMID: 21232143; PMCID: PMC3031281.
12. Roberts P, Abel M, Rosen L, Cirocco W, Fleshman J, Leff E, Levien D, Pritchard T, Wexner S, Hicks T, et al. Practice parameters for sigmoid diverticulitis. The Standards Task Force American Society of Colon and Rectal Surgeons. Dis Colon Rectum. 1995 Feb;38(2):125-32.
13. Wong WD, Wexner SD, Lowry A, Vernava A 3rd, Burnstein M, Denstman F, Fazio V, Kerner B, Moore R, Oliver G, Peters W, Ross T, Senatore P, Simmang C. Practice parameters for the treatment of sigmoid diverticulitis--supporting documentation. The Standards Task Force. The American Society of Colon and Rectal Surgeons. Dis Colon Rectum. 2000 Mar;43(3):290-7. doi: 10.1007/BF02258291. PMID: 10733108.
14. Rafferty J, Shellito P, Hyman NH, Buie WD; Standards Committee of American Society of Colon and Rectal Surgeons. Practice parameters for sigmoid diverticulitis. Dis Colon Rectum. 2006 Jul;49(7):939-44. doi: 10.1007/s10350-006-0578-2. PMID: 16741596.
15. Feingold D, Steele SR, Lee S, Kaiser A, Boushey R, Buie WD, Rafferty JF. Practice parameters for the treatment of sigmoid diverticulitis. Dis Colon Rectum. 2014 Mar;57(3):284-94. doi: 10.1097/DCR.0000000000000075. PMID: 24509449.

16. Hall J, Hardiman K, Lee S, Lightner A, Stocchi L, Paquette IM, Steele SR, Feingold DL; Prepared on behalf of the Clinical Practice Guidelines Committee of the American Society of Colon and Rectal Surgeons. The American Society of Colon and Rectal Surgeons Clinical Practice Guidelines for the Treatment of Left-Sided Colonic Diverticulitis. Dis Colon Rectum. 2020 Jun;63(6):728-747. doi: 10.1097/DCR.0000000000001679. PMID: 32384404.
17. Francis NK, Sylla P, Abou-Khalil M, Arolfo S, Berler D, Curtis NJ, Dolejs SC, Garfinkle R, Gorter-Stam M, Hashimoto DA, Hassinger TE, Molenaar CJL, Pucher PH, Schuermans V, Arezzo A, Agresta F, Antoniou SA, Arulampalam T, Boutros M, Bouvy N, Campbell K, Francone T, Haggerty SP, Hedrick TL, Stefanidis D, Truitt MS, Kelly J, Ket H, Dunkin BJ, Pietrabissa A. EAES and SAGES 2018 consensus conference on acute diverticulitis management: evidence-based recommendations for clinical practice. Surg Endosc. 2019 Sep;33(9):2726-2741. doi: 10.1007/s00464-019-06882-z. Epub 2019 Jun 27. PMID: 31250244; PMCID: PMC6684540.
18. Köhler L, Sauerland S, Neugebauer E. Diagnosis and treatment of diverticular disease: results of a consensus development conference. The Scientific Committee of the European Association for Endoscopic Surgery. Surg Endosc. 1999 Apr;13(4):430-6. doi: 10.1007/s004649901007. PMID: 10094765.
19. Pietrzak A, Bartnik W, Szczepkowski M, Krokowicz P, Dziki A, Reguła J, Wallner G. Polish interdisciplinary consensus on diagnostics and treatment of colonic diverticulosis (2015). Pol Przegl Chir. 2015 Apr;87(4):203-20. doi: 10.1515/pjs-2015-0045. PMID: 26146121.
20. Binda GA, Cuomo R, Laghi A, Nascimbeni R, Serventi A, Bellini D, Gervaz P, Annibale B; Italian Society of Colon and Rectal Surgery. Practice parameters for the treatment of colonic diverticular disease: Italian Society of Colon and Rectal Surgery (SICCR) guidelines. Tech Coloproctol. 2015 Oct;19(10):615-26. doi: 10.1007/s10151-015-1370-x. Epub 2015 Sep 16. PMID: 26377584.
21. Cuomo R, Barbara G, Pace F, Annese V, Bassotti G, Binda GA, Casetti T, Colecchia A, Festi D, Fiocca R, Laghi A, Maconi G, Nascimbeni R, Scarpignato C, Villanacci V, Annibale B. Italian consensus conference for colonic diverticulosis and diverticular disease. United European Gastroenterol J. 2014 Oct;2(5):413-42. doi: 10.1177/2050640614547068. PMID: 25360320; PMCID: PMC4212498.
22. Andeweg CS, Mulder IM, Felt-Bersma RJ, Verbon A, van der Wilt GJ, van Goor H, Lange JF, Stoker J, Boermeester MA, Bleichrodt RP; Netherlands Society of Surgery; Working group from Netherlands Societies of Internal Medicine, Gastroenterologists, Radiology, Health echnology Assessment and Dieticians. Guidelines of diagnostics and treatment of acute left-sided colonic diverticulitis. Dig Surg. 2013;30(4-6):278-92. doi: 10.1159/000354035. Epub 2013 Aug 20. PMID: 23969324.
23. Andersen JC, Bundgaard L, Elbrønd H, Laurberg S, Walker LR, Støvring J; Danish Surgical Society. Danish national guidelines for treatment of diverticular disease. Dan Med J. 2012 May;59(5):C4453. PMID: 22549495.
24. NICE guideline. Diverticular disease: diagnosis and management. Published: 27 November 2019 www.nice.org.uk/guidance/ng147
25. Fozard JB, Armitage NC, Schofield JB, Jones OM; Association of Coloproctology of Great Britain and Ireland. ACPGBI position statement on elective resection for diverticulitis. Colorectal Dis. 2011 Apr;13 Suppl 3:1-11. doi: 10.1111/j.1463-1318.2010.02531.x. PMID: 21366820.
26. Peery AF, Shaukat A, Strate LL. AGA Clinical Practice Update on Medical Management of Colonic Diverticulitis: Expert Review. Gastroenterology. 2021 Feb;160(3):906-911.e1. doi: 10.1053/j.gastro.2020.09.059. Epub 2020 Dec 3. PMID: 33279517; PMCID: PMC7878331.
27. Nagata N, Ishii N, Manabe N, Tomizawa K, Urita Y, Funabiki T, Fujimori S, Kaise M. Guidelines for Colonic Diverticular Bleeding and Colonic Diverticulitis: Japan Gastroenterological Association. Digestion 2019; 99 Suppl 1: 1-26
28. de Wit NJ, Berger MY, Vogelenzang R, Wetzels RV, van Rijn-van Kortenhof NM, Opstelten W, Goudswaard AN. Samenvatting van de NHG-standaard 'Diverticulitis' [Summary of the Dutch College of General Practitioners (NHG) practice guideline on 'Diverticulitis']. Ned Tijdschr Geneeskd. 2012;156(5):A4140. Dutch. PMID: 22296900.
29. Tonelli F, Di Carlo V, Liscia G, Serventi A. La malattia diverticolare del colon: quando e come trattarla. Consensus Conference- del quinto Congresso Nazionale della Società Italiana dei Chirurghi Universitari (S.I.C.U.) [Diverticular disease of the colon: diagnosis and treatment. Consensus Conference, 5th National Congress of the Italian Society of Academic Surgeons]. Ann Ital Chir. 2009 Jan-Feb;80(1):3-8.

30. Raña-Garibay R, Salgado-Nesme N, Carmona-Sánchez R, Remes-Troche JM, Aguilera-Carrera J, Alonso-Sánchez L, Arnaud-Carreño C, Charúa-Guindic L, Coss-Adame E, de la Torre-Bravo A, Espinosa-Medina D, Esquivel-Ayanegui F, Roesch-Dietlen F, López-Colombo A, Muñoz-Torres JI, Noble-Lugo A, Rojas-Mendoza F, Suazo-Barahona J, Stoopen-Rometti M, Torres-Flores E, Vallejo-Soto M, Vergara-Fernández O. The Mexican consensus on the diagnosis and treatment of diverticular disease of the colon. Rev Gastroenterol Mex. 2019 Apr-Jun;84(2):220-240. English, Spanish. doi: 10.1016/j.rgmx.2019.01.002. Epub 2019 Apr 20.
31. Societe Nationale Francaise de Gastroenterologie, Societe Francaise de Chirurgie Digestive. [Recommendations. Colonic diverticulosis]. [French]. Gastroenterol Clin Biol 2007; 31(8-9 Pt 2):3S5–13.
32. Lledó-Matoses S. (2000) [Guías clínicas de la Asociación Española de Cirujanos]. Arán Ediciones, S.A.; Madrid http://www.aecirujanos.es/publicados_por_la_AEC/guia_cirugia_colorrectal_prologo.php.
33. Fugazzola P, Ceresoli M, Coccolini F, Gabrielli F, Puzziello A, Monzani F, Amato B, Sganga G, Sartelli M, Menichetti F, Puglisi GA, Tartaglia D, Carcoforo P, Avenia N, Kluger Y, Paolillo C, Zago M, Leppäniemi A, Tomasoni M, Cobianchi L, Dal Mas F, Improta M, Moore EE, Peitzman AB, Sugrue M, Agnoletti V, Fraga GP, Weber DG, Damaskos D, Abu-Zidan FM, Wani I, Kirkpatrick AW, Pikoulis M, Pararas N, Tan E, Broek RT, Maier RV, Davies RJ, Kashuk J, Shelat VG, Mefire AC, Augustin G, Magnone S, Poiasina E, De Simone B, Chiarugi M, Biffl W, Baiocchi GL, Catena F, Ansaloni L. The WSES/SICG/ACOI/SICUT/AcEMC/SIFIPAC guidelines for diagnosis and treatment of acute left colonic diverticulitis in the elderly. World J Emerg Surg. 2022 Jan 21;17(1):5. doi: 10.1186/s13017-022-00408-0. PMID: 35063008; PMCID: PMC8781436.
34. Agresta F, Ansaloni L, Baiocchi GL, Bergamini C, Campanile FC, Carlucci M, Cocorullo G, Corradi A, Franzato B, Lupo M, Mandalà V, Mirabella A, Pernazza G, Piccoli M, Staudacher C, Vettoretto N, Zago M, Lettieri E, Levati A, Pietrini D, Scaglione M, De Masi S, De Placido G, Francucci M, Rasi M, Fingerhut A, Uranüs S, Garattini S. Laparoscopic approach to acute abdomen from the Consensus Development Conference of the Società Italiana di Chirurgia Endoscopica e nuove tecnologie (SICE), Associazione Chirurghi Ospedalieri Italiani (ACOI), Società Italiana di Chirurgia (SIC), Società Italiana di Chirurgia d'Urgenza e del Trauma (SICUT), Società Italiana di Chirurgia nell'Ospedalità Privata (SICOP), and the European Association for Endoscopic Surgery (EAES). Surg Endosc. 2012 Aug;26(8):2134-64. doi: 10.1007/s00464-012-2331-3. Epub 2012 Jun 27. PMID: 22736283.
35. AGREE Next Step Consortium. AGREE II. Checklist per valutare la qualità delle linee guida. Fondazione GIMBE: Bologna, luglio 2019. Disponibile a: www.gimbe.org/agree. Ultimo accesso: 7 Giugno 2023.
36. Gregersen R, Mortensen LQ, Burcharth J, Pommergaard HC, Rosenberg J. Treatment of patients with acute colonic diverticulitis complicated by abscess formation: a systematic review. Int J Surg 2016; 35: 201–8.
37. Lambrichts DPV, Bolkenstein HE, van der Does D et al. Multicentre study of non-surgical management of diverticulitis with abscess formation. Br J Surg 2019; 106: 458–66.
38. Brandt D, Gervaz P, Durmishi Y, Platon A, Morel P, Poletti PA. Percutaneous CT scan-guided drainage vs. antibiotherapy alone for Hinchey II diverticulitis: a case-control study. Dis Colon Rectum. 2006;49:1533–1538.
39. Elagili F, Stocchi L, Ozuner G, Kiran RP. Antibiotics alone instead of percutaneous drainage as initial treatment of large diverticular abscess. Tech Coloproctol. 2015;19:97–103.
40. Gregersen R, Andresen K, Burcharth J, Pommergaard HC, Rosenberg J. Short-term mortality, readmission, and recurrence in treatment of acute diverticulitis with abscess formation: a nationwide register-based cohort study. International Journal of Colorectal Disease. 2016; 31(5):983-90 10.
41. Kaiser AM, Jiang JK, Lake JP, Ault G, Artinyan A, Gonzalez-Ruiz C et al. The management of complicated diverticulitis and the role of computed tomography. American Journal of Gastroenterology. 2005; 100(4):910-7
42. Siewert B, Tye G, Kruskal J, Sosna J, Opelka F, Raptopoulos V et al. Impact of CTguided drainage in the treatment of diverticular abscesses: size matters. American Journal of Roentgenology. 2006; 186(3):680-6 26.
43. Subhas G, Rana G, Bhullar J, Essad K, Mohey L, Mittal VK. Percutaneous drainage of a diverticular abscess should be limited to two attempts for a resilient diverticular abscess. American Surgeon. 2014; 80(7):635-9
44. Buchwald P, Dixon L, Wakeman CJ, Eglinton TW, Frizelle FA. Hinchey I and II diverticular abscesses: long-term outcome of conservative treatment. ANZ Journal of Surgery. 2017; 87(02):1011-1014
45. Gregersen R, Mortensen LQ, Burcharth J, Pommergaard HC, Rosenberg J. Treatment of patients with acute colonic diverticulitis complicated by abscess formation: A systematic review. Int J Surg. 2016;35:201-8

46. Gaertner WB, Willis DJ, Madoff RD, Rothenberger DA, Kwaan MR, Belzer GE, et al. Percutaneous drainage of colonic diverticular abscess: is colon resection necessary? Dis Colon Rectum. 2013;56(5):622-6.
47. Kaiser AM, Jiang JK, Lake JP, Ault G, Artinyan A, Gonzalez-Ruiz C, et al. The management of complicated diverticulitis and the role of computed tomography. Am J Gastroenterol. 2005;100(4):910-7
48. Ambrosetti P, Chautems R, Soravia C, Peiris-Waser N, Terrier F. Long-term outcome of mesocolic and pelvic diverticular abscesses of the left colon: a prospective study of 73 cases. Dis Colon Rectum. 2005;48:787–91
49. Brandt D, Gervaz P, Durmishi Y, Platon A, Morel P, Poletti PA. Percutaneous CT scan guided drainage versus antibiotherapy alone for Hinchey II diverticulitis: a case-control study. Dis Colon Rectum. 2006;49:1533–8
50. Siewert B, Tye G, Kruskal J, Sosna J, Opelka F, Raptopoulos V, et al. Impact of CT-guided drainage in the treatment of diverticular abscesses: size matters. AJR. 2006;186:680–6.
51. Singh B, May K, Coltart I, Moore NR, Cunningham C. The long-term results of percutaneous drainage of diverticular abscess. Ann R Coll Surg Engl. 2008;90:297–301.
52. Kumar RR, Kim JT, Haukoos JS, Macias LH, Dixon MR, Stamos MJ, et al. Factors affecting the successful management of intra-abdominal abscesses with antibiotics and the need for percutaneous drainage. Dis Colon Rectum. 2006;49:183–9.
53. Ambrosetti P, Chautems R, Soravia C, Peiris-Waser N, Terrier F. Long-term outcome of mesocolic and pelvic diverticular abscesses of the left colon: a prospective study of 73 cases. Dis Colon Rectum 2005;48:787– 91.
54. Ambrosetti P, Robert J, Witzig JA, Mirescu D, de Gautard R, Borst F, Rohner A (1992) Incidence, outcome, and proposed management of isolated abscesses complicating acute left-sided colonic diverticulitis. A prospective study of 140 patients. Dis Colon Rectum 35: 1072–1076
55. Ambrosetti P, Chautems R, Soravia C et al. Long-term outcome of mesocolic and pelvic diverticular abscesses of the left colon: a prospective study of 73 cases. Dis Colon Rectum 2005;48:787-91 55.
56. Siewert B, Tye G, Kruskal J et al. Impact of CT-guided drainage in the Treatment of Diverticular Abscesses: Size Matters. AJR 2006; 186: 680-686 56.
57. Durmishi Y, Gervaz P, Brandt D et al. Results from percutaneous drainage of Hinchey stage II diverticulitis guided by computer tomography scan. Surg Endosc 2006;20:1129-33 57. Kumar R, Kim JT, Haukoos JS et al. Factors affecting the successful management of intra-abdominal abscesses with antibiotics and the need for percutaneous drainage. Dis Colon Rectum 2006; Feb;49(2):183-9
58. Bahadursingh AM, Virgo KS , Kaminski DL , Longo WE: Spectrum of disease and outcome ofcomplicated diverticular disease. Am J Surg 2003;186: 696-701.
59. Ambrosetti P, Chautems R, Soravia C et al.: Long-term outcome of mesocolic and pelvic diverticular abscesses of the left colon: a prospective study of 73 cases. Dis Colon Rectum 2005; 48: 787-
60. .Kumar RR , Kim JT, Haukoos JS et al.: Factors affecting the successful management of intra-abdominal abscesses with antibiotics and the need for percutaneous drainage. Dis Colon Rectum 2006; 49: 183-89
61. Brandt D, Gervaz P, Durmishi Y, et al. Percutaneous CT scan-guided drainage versus antibiotherapy alone for Hinchey II diverticulitis: a case-control study. Dis Colon Rectum. 2006;49:1533–1538. 30.
62. Ambrosetti P, Chautems R, Soravia C, Peiris-Waser N, Terrier F. Long-term outcome of mesocolic and pelvic diverticular abscesses of the left colon: a prospective study of 73 cases. Dis Colon Rectum. 2005;48:787–791. 31.
63. Kaiser AM, Jiang JK, Lake JP, et al. The management of complicated diverticulitis and the role of computed tomography. Am J Gastroenterol. 2005;100:910–917. 32.
64. Kumar RR, Kim JT, Haukoos JS, et al. Factors affecting the successful management of intra-abdominal abscesses with antibiotics and the need for percutaneous drainage. Dis Colon Rectum. 2006;49:183–189
65. Kaiser AM, Jiang JK, Lake JP, et al: The management of complicated diverticulitis and the role of computed tomography. Am J Gastroenterol 2005;100:910–917.
66. Siewert B, Tye G, Kruskal J, et al: Impact of CT-guided drainage in the treatment of diverticular abscesses: size matters. Am J Roentgenol 2006;186:680–686. 111
67. Brandt D, Gervaz P, Durmishi Y, et al: Percutaneous CT scan-guided drainage versus antibiotherapy alone for Hinchey II diverticulitis: a case-control study. Dis Colon Rectum 2006;49:1533–1538. 112
68. Kumar RR, Kim JT, Haukoos JS, et al: Factors affecting the successful management of intra-abdominal abscesses with antibiotics and the need for percutaneous drainage. Dis Colon Rectum 2006;49:183–189. 113

69. Durmishi Y, Gervaz P, Brandt D, et al: Results from percutaneous drainage of Hinchey stage II diverticulitis guided by computed tomography scan. Surg Endosc 2006; 20: 1129–1133.
70. Lamb MN, Kaiser AM (2014) Elective resection versus observation after nonoperative management of complicated diverticulitis with abscess: a systematic review and meta-analysis. Dis Colon Rectum 57:1430–1440
71. Ambrosetti P, Chautems R, Soravia C, Peiris-Waser N, Terrier F (2005) Long-term outcome of mesocolic and pelvic diverticular abscesses of the left colon: a prospective study of 73 cases. Dis Colon Rectum 48:787–791
72. Brandt D, Gervaz P, Durmishi Y, Platon A, Morel P, Poletti PA (2006) Percutaneous CT scan-guided drainage vs. antibiotherapy alone for Hinchey II diverticulitis: a case-control study. Dis Colon Rectum 49:1533–1538
73. Brandt D, Gervaz P, Durmishi Y, et al. Percutaneous CT scan-guided drainage vs. antibiotherapy alone for Hinchey II diverticulitis: A case-control study. Dis Colon Rectum 2006; 49: 1533–1538. 279.
74. Siewert B, Tye G, Kruskal J, et al. Impact of CT-guided drainage in the treatment of diverticular abscesses: Size matters. Am J Roentgenol 2006; 186: 680–684.
75. Kumar R, Kim JT, Haukoos JS, et al. Factors affecting the successful management of intra-abdominal abscesses with antibiotics and the need for percutaneous drainage. Dis Colon Rectum 2006; 49: 183–189.
76. Ambrosetti P, Robert J, Witzig JA, Mirescu D, de Gautard R, Borst F, Rohner A: Incidence, outcome, and proposed management of isolated abscesses complicating acute left-sided colonic diverticulitis: a prospective study of 140 patients. Dis Colon Rectum 1992, 35:1072-1076.
77. Siewert B, Tye G, Kruskal J, Sosna J, Opelka F, Raptopoulos V, Goldberg SN: Impact of CT-guided drainage in the treatment of diverticular abscesses: size matters. AJR Am J Roentgenol 2006, 186:680-686, [Erratum, AJR Am J Roentgenol 2007; 189:512.].
78. Kumar RR, Kim JT, Haukoos JS, Macias LH, Dixon MR, Stamos MJ, Konyalian VR: Factors affecting the successful management of intraabdominal abscesses with antibiotics and the need for percutaneous drainage. Dis Colon Rectum 2006, 49:183-189.
79. Ambrosetti P, Chautems R, Soravia C, Peiris-Waser N, Terrier F. Long-term outcome of mesocolic and pelvic diverticular abscesses of the left colon: a prospective study of 73 cases. Dis Colon Rectum. 2005;48:787–91.
80. Brandt D, Gervaz P, Durmishi Y, Platon A, Morel P, Poletti PA. Percutaneous CT scan guided drainage versus antibiotherapy alone for Hinchey II diverticulitis: a case–control study. Dis Colon Rectum. 2006;49:1533–8.
81. Siewert B, Tye G, Kruskal J, Sosna J, Opelka F, Raptopoulos V, Goldberg SN. Impact of CT-guided drainage in the treatment of diverticular abscesses: size matters. AJR Am J Roentgenol. 2006;186:680–6.
82. Singh B, May K, Coltart I, Moore NR, Cunningham C. The long-term results of percutaneous drainage of diverticular abscess. Ann R Coll Surg Engl. 2008;90:297–301.
83. Kumar RR, Kim JT, Haukoos JS, Macias LH, Dixon MR, Stamos MJ, Konyalian VR. Factors affecting the successful management of intra-abdominal abscesses with antibiotics and the need for percutaneous drainage. Dis Colon Rectum. 2006;49:183–9.
84. Ambrosetti P, Chautems R, Soravia C, Peiris Waser N, Terrier F: Long-term outcome of mesocolic and pelvic diverticular abscesses of the left colon: a prospective study of 73 cases. Dis Colon Rectum 2005; 48: 787–791.
85. Hamy A, Paineau J: Société de chirurgie viscérale de l'ouest (SCVO). Percutaneous drainage of perisigmoid abscesses of diverticular origin (in French). Ann Chir 2001; 126: 133–137.
86. Brandt D, Gervaz P, Durmishi Y, Platon A, Morel P, Poletti PA: Percutaneous CT scanguided drainage versus antibiotherapy alone for Hinchey II diverticulitis: a case-control study. Dis Colon Rectum 2006; 49: 1533–1538.
87. Siewert B, Tye G, Kruskal J, Sosna J, Opelka F, Raptopoulos V, Goldberg SN: Impact of CT-guided drainage in the treatment of diverticular abscesses: size matters. AJR Am J Roentgenol 2006; 186: 680–686.
88. Singh B, May K, Coltart I, Moore NR, Cunningham C: The long-term results of percutaneous drainage of diverticular abscess. Ann R Coll Surg Engl 2008; 90: 297–301.
89. Beresneva O, Donohue K, Kuhnen AH. Abscess management in left-sided diverticulitis. Seminars in Colon and Rectal Surgery 2021; 32 (1): 100798

90. Lambrichts DPV, Bolkenstein HE, van der Does DCHE, Dieleman D, Crolla RMPH, Dekker JWT, van Duijvendijk P, Gerhards MF, Nienhuijs SW, Menon AG, de Graaf EJR, Consten ECJ, Draaisma WA, Broeders IAMJ, Bemelman WA, Lange JF. Multicentre study of non-surgical management of diverticulitis with abscess formation. Br J Surg. 2019 Mar;106(4):458-466. doi: 10.1002/bjs.11129. PMID: 30811050; PMCID: PMC6593757.
91. Brandt D, Gervaz P, Durmishi Y, Platon A, Morel P, Poletti PA. Percutaneous CT scan-guided drainage vs. antibiotherapy alone for Hinchey II diverticulitis: a case-control study. Dis Colon Rectum. 2006 Oct;49(10):1533-8. doi: 10.1007/s10350-006-0613-3. PMID: 16988856.
92. National Guideline Centre (UK). Evidence review for percutaneous drainage versus resectional surgery for the management of abscesses: Diverticular disease: diagnosis and management: Evidence review N. London: National Institute for Health and Care Excellence (NICE); 2019 Nov. (NICE Guideline, No. 147.) Available from: https://www.ncbi.nlm.nih.gov/books/NBK558093/.
93. Mali, J., Mentula, P., Leppäniemi, A. et al. Determinants of treatment and outcomes of diverticular abscesses. World J Emerg Surg 14, 31 (2019). https://doi.org/10.1186/s13017-019-0250-5
94. Kruis, W, Germer, C-T, Böhm, S, Dumoulin, FL, Frieling, T, Hampe, J, et al. German guideline diverticular disease/diverticulitis. *United European Gastroenterol J*. 2022; 10(9): 940– 57.
95. Hall J, Hardiman K, Lee S, Lightner A, Stocchi L, Paquette IM, Steele SR, Feingold DL; Prepared on behalf of the Clinical Practice Guidelines Committee of the American Society of Colon and Rectal Surgeons. The American Society of Colon and Rectal Surgeons Clinical Practice Guidelines for the Treatment of Left-Sided Colonic Diverticulitis. Dis Colon Rectum. 2020 Jun;63(6):728-747. doi: 10.1097/DCR.0000000000001679. PMID: 32384404.
96. NICE guideline. Diverticular disease: diagnosis and management. Published: 27 November 2019 www.nice.org.uk/guidance/ng147
97. Sartelli M, Weber DG, Kluger Y, Ansaloni L, Coccolini F, Abu-Zidan F, Augustin G, Ben-Ishay O, Biffl WL, Bouliaris K, Catena R, Ceresoli M, Chiara O, Chiarugi M, Coimbra R, Cortese F, Cui Y, Damaskos D, De' Angelis GL, Delibegovic S, Demetrashvili Z, De Simone B, Di Marzo F, Di Saverio S, Duane TM, Faro MP, Fraga GP, Gkiokas G, Gomes CA, Hardcastle TC, Hecker A, Karamarkovic A, Kashuk J, Khokha V, Kirkpatrick AW, Kok KYY, Inaba K, Isik A, Labricciosa FM, Latifi R, Leppäniemi A, Litvin A, Mazuski JE, Maier RV, Marwah S, McFarlane M, Moore EE, Moore FA, Negoi I, Pagani L, Rasa K, Rubio-Perez I, Sakakushev B, Sato N, Sganga G, Siquini W, Tarasconi A, Tolonen M, Ulrych J, Zachariah SK, Catena F. 2020 update of the WSES guidelines for the management of acute colonic diverticulitis in the emergency setting. World J Emerg Surg. 2020 May 7;15(1):32. doi: 10.1186/s13017-020-00313-4. PMID: 32381121; PMCID: PMC7206757.
98. Mali, J., Mentula, P., Leppäniemi, A. *et al.* Determinants of treatment and outcomes of diverticular abscesses. *World J Emerg Surg* **14**, 31 (2019).
99. Elagili, F., Stocchi, L., Ozuner, G. *et al.* Antibiotics alone instead of percutaneous drainage as initial treatment of large diverticular abscess. *Tech Coloproctol* **19**, 97–103 (2015).
100. Buchwald, P., Dixon, L., Wakeman, C.J., Eglinton, T.W. and Frizelle, F.A. (2017), Hinchey I and II diverticular abscesses: long-term outcome of conservative treatment. ANZ J Surg, 87: 1011-1014.