

Elective surgery after acute diverticulitis

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Background: Diverticulitis is a common condition. Practice guidelines from many organizations recommend bowel resection after two attacks. The evidence for such a recommendation is reviewed.

Methods: A Medline literature search was performed to locate English language articles on surgery for diverticular disease. Further articles were obtained from the references cited in the literature initially reviewed.

Results: Most people with diverticulosis are asymptomatic. Diverticular disease occurs in over 25 per cent of the population, increasing with age. After one episode of diverticulitis one-third of patients have recurrent symptoms; after a second episode a further third have a subsequent episode. Perforation is commonest during the first episode of acute diverticulitis. After recovering from an episode of diverticulitis the risk of an individual requiring an urgent Hartmann's procedure is one in 2000 patient-years of follow-up. Surgery for diverticular disease has a high complication rate and 25 per cent of patients have ongoing symptoms after bowel resection.

Conclusion: There is no evidence to support the idea that elective surgery should follow two attacks of diverticulitis. Further prospective trials are required.

Paper accepted 12 October 2004

Published online in Wiley InterScience (www.bjs.co.uk). DOI: 10.1002/bjs.4873

Introduction

In Western countries, the prevalence of diverticular disease has increased over the past century¹. This probably reflects both an increase in detection and an ageing population. Diverticular disease is currently one of the five most costly gastrointestinal disorders affecting the US population². Until 30 years ago, the proportion requiring operation or dying from diverticular disease was decreasing³; however, during the past 20 years the rates of admission and surgical intervention have increased, while inpatient and population mortality rates remain unchanged⁴. This increasing burden of disease demands robust, evidence-based management guidelines; implementing routine elective resection in a growing cohort of patients is costly for both healthcare providers and patients alike.

At present there appears to be consensus in the literature that elective surgical resection should be undertaken after two episodes of uncomplicated diverticulitis. 'Practice parameters for sigmoid diverticulitis' was produced for the American Society of Colon and Rectal Surgeons

(ASCRS), initially published in 1995⁵ and revised in 2000⁶. In this it is stated 'The risk of recurrent symptoms following an episode of diverticulitis ranges from 7 to 45 per cent' and 'With each recurrent attack the patient is less likely to respond to medical therapy (70 per cent chance the patient will respond with first episode as compared to 6 per cent chance with the third episode)', quoting a publication by Parks⁷ in 1969 as the basis of these latter figures. It is concluded 'Thus after two attacks of uncomplicated diverticulitis resection is recommended'. In a similar publication regarding the treatment of diverticulitis produced by the Ad Hoc Practice Parameters Committee of the American College of Gastroenterology⁸, it was concluded 'Recurrent attacks are less likely to respond to medical therapy and have a higher mortality rate, therefore most authorities agree that elective resection is indicated after two attacks of uncomplicated diverticulitis . . .'. Only two publications are quoted to support this – the 1995 ASCRS document⁵ and Parks' 1969 publication⁷.

As recently as 2004 the same advice has been given in a review article in *The Lancet*⁹. It states 'Recurrent attacks are less likely to respond to medical treatment and have a high mortality rate'; again, the only supporting references are the ASCRS practice parameters and Parks' 1969 publication. The article goes on to state 'Thus, most authorities agree that elective resection is indicated after two attacks of uncomplicated diverticulitis', quoting three consensus statements to support this contention, including the above-mentioned two American publications and recommendations of the Scientific Committee of the European Association for Endoscopic Surgery¹⁰. Similarly, in another recent review article¹¹ it was stated 'Patients who have recurrent episodes of diverticulitis have a 60 per cent risk of complications, hence the rationale for surgical treatment after two documented episodes of diverticulitis'. Here, a single publication by Faramakis *et al.*¹² is quoted to support this advice.

It is difficult to know where the now apparently standard advice regarding elective resection originated. In the early part of the last century surgery was reserved for patients with severe complications, and the mortality rate was high¹³. By the 1950s, antibiotic use was widespread, and elective resection of uncomplicated diverticular disease gained popularity^{14–17}.

In recommending elective resection, the cost related to the morbidity and mortality of all subsequent attacks (including emergency surgery) must be weighed against the morbidity, mortality and costs of elective resection. The mortality rate after elective resection increases from 0 to 15 per cent with advancing age¹⁸. Bokey *et al.*¹⁸ demonstrated that elective diverticular disease resection was associated with higher rates of morbidity and mortality than elective colorectal carcinoma resection. Surgery is often not the end of a patient's problems. Some 1.0–10.4 per cent develop recurrent diverticulitis after resection, of whom 0–3.1 per cent require a further resection^{12,19–22}; persisting symptoms are found in 27–33 per cent^{7,23}. The modern recognition that the distal anastomosis must be on the upper rectum may have reduced this recurrence rate²⁴.

Colonic diverticulitis is one of the commonest surgical conditions encountered in the Western world, and such recommendations regarding the place of elective surgical resection following successful conservative management have widespread implications. The aim of this review is to examine whether the evidence in the literature actually supports the recommendations outlined above.

Natural history of diverticular disease

The prognosis of patients admitted to hospital with diverticular disease is uncertain, owing to poor-quality data. The main problems are that the data are often retrospective, there is insufficient follow-up, and it has been assumed (in older studies) that admissions for abdominal pain were related to diverticular disease^{25,26}. The risk of recurrent symptoms varies from 7 to 45 per cent^{27–30}, reflecting a broad spectrum of disease severity and diagnostic criteria in various studies.

An early study showed that only two of 503 patients with diverticulitis required operation during 18 years of follow-up, despite 37 per cent of patients remaining symptomatic³¹. In a series of 673 patients with diverticular disease, only 3 per cent required emergency operations during 10 years' follow-up³². Much of the current knowledge on the natural history of diverticular disease comes from Parks' pioneering works^{7,33–36}. He and his colleagues followed 455 patients over 1–16 years, achieving complete follow-up for 99.6 per cent^{7,33,34}. Of 317 patients treated medically on their first admission, 25 per cent were admitted with a second attack, 4 per cent with a third attack and 1.6 per cent with a fourth attack⁷. The mortality rate increased from 4.7 per cent during the first admission to 7.8 per cent during subsequent admissions. Supposing all recorded episodes were actually recurrent disease, elective resection after a second attack would have prevented only 17 readmissions, at a cost of 61 unnecessary operations. In this series, the postoperative mortality rate was 11 per cent and so the risk associated with elective resection outweighed any potential benefit. Parks' conclusion that 'medical treatment of recurrent disease is less rewarding'⁷ is widely quoted, but the diagnosis of recurrent diverticulitis was tentative in many patients in this study.

When one looks at Parks' data closely the accuracy of the diagnosis of diverticulitis is questionable. Some patients may have had irritable bowel syndrome; approximately one-third had persistent symptoms, whether treated medically or surgically⁷. Furthermore, only half the barium enemas demonstrated changes consistent with diverticulitis, and a quarter of the enemas were done on patients with no history of pain³³. Sixty-two per cent described altered bowel habit, which was associated with a worse prognosis⁷. One-quarter had symptoms lasting more than a year before admission (up to 30 years in some patients), and half remained symptomatic during follow-up. This can be compared with figures for those who had a history of less than 1 month, only a quarter of whom remained symptomatic during follow-up. Parks suggested

that 'irritable colon' may have contributed to persistent symptoms⁷.

As stated above, various groups cite Parks' data as evidence supporting elective resection after a second admission, yet Parks did not reach the same conclusion, rather recommending 'very careful selection' because a high proportion remained symptomatic despite resection³³. Furthermore, Parks never found that the likelihood of responding to medical treatment decreased from 70 per cent in the first episode to 6 per cent with the third episode, as is widely quoted^{5,6}.

A lower readmission trend was demonstrated in 366 Finnish patients over a mean follow-up of 10 years³⁷. Eighty-four per cent were treated only once, 8 per cent twice, 5 per cent three times, and 3 per cent were admitted four times. During follow-up, no deaths were attributable to recurrent diverticular disease, and recurrence was not associated with an increased rate of complications or less successful medical management. Although 28 per cent of patients underwent surgery, more than one-third of operations were for 'diverticulitis' with no evidence of perforation, fistula, stricture or bleeding. Of 51 operations for perforation, 35 per cent were Hinchey stage I³⁸ (Table 1), which could potentially be managed conservatively³⁹. Despite this, the authors recommended elective resection after two attacks of uncomplicated diverticular disease. Had this rationale been employed, 29 recurrent episodes would have been prevented at a cost of 57 operations, of which 28 would have been unnecessary.

Haglund *et al.*²⁸ noted that 25 per cent of 392 patients required emergency operation after the first attack, with an operative mortality rate of 20 per cent. Of the remaining 295 medically treated patients, one-quarter developed recurrent diverticulitis during 2–12 years of follow-up. In contrast to Parks' findings, the risk of recurrence in the first year was 10 per cent, but fell to approximately 3 per cent per year thereafter. No perforations occurred during follow-up, and the majority of complications were associated with the first attack. Following the initial attack, the disease appeared to run a benign course, with more risk of death from unrelated disease than from complications of acute diverticulitis²⁸. These authors concluded that elective resection was not justified. A prospective evaluation of 226 consecutive patients demonstrated that only 5 per cent

of medically treated patients suffered recurrence within 2 years of the initial attack⁴⁰, although the mean follow-up was only 25 months. The findings of studies relating to the natural history of diverticular disease are summarized in Table 2.

Complicated diverticulitis

Conservative treatment of acute uncomplicated diverticulitis results in resolution of symptoms in 70–100 per cent of patients^{28,39,44–47}. Data on the natural history of complicated diverticular disease are limited, with divergent results indicating differences in patient selection and follow-up (Table 3). The available data vary with the type of complication; for example, the natural history of fistulous disease is different from that of stricture and of giant diverticular disease^{39,44–47,50}.

Faramakis *et al.*^{12,51} reported a prospective series of 120 patients from 30 centres followed for 5 years after admission with complicated diverticulitis (defined as diverticulitis with associated abscess, fistula, obstruction or free perforation⁶). Although the majority remained asymptomatic during follow-up, 39 patients (32.5 per cent) developed a severe complication, of whom ten died as a result. The authors recommended interval sigmoid colectomy after the initial attack to prevent late complications. However, almost two-thirds of recurrent complications were unrelated to the initial complicated attack, and three times as many patients died from causes unrelated to diverticular disease. Most patients with repeat complications were elderly with coexisting severe cardiorespiratory disease¹². Consequently, many were unsuitable for elective resection, and the results are not therefore generalizable. In addition, follow-up was via a questionnaire sent to general practitioners. This introduces recall bias, because practitioners may remember more severely ill patients. The questionnaire was not presented, so its validity is unknown, and the low response rate (40 per cent) indicates potential response bias. Initial management of the cohort varied widely, reflecting the large number of centres involved. The authors suggest that pericolic abscesses can be drained radiologically⁵¹, but less than 12 per cent of pericolic abscesses were treated this way. In line with other studies^{3,26,48} this report highlights that individual consultant surgeons encounter only two or three cases of complicated diverticulitis each year.

Limited exposure to a problem not only adversely affects decision making and operative expertise, it limits prospective studies. Ambrosetti *et al.*³⁰ attempted to randomize patients to elective colectomy or conservative treatment after a first attack. After a mean follow-up of 19 months, only four (8 per cent) of 52 patients

Table 1 Hinchey stages³⁸

Stage I	Diverticulitis associated with pericolic abscess
Stage II	Distant abscess (retroperitoneal or pelvic)
Stage III	Purulent peritonitis
Stage IV	Faecal peritonitis

Table 2 Studies of the natural history of uncomplicated diverticular disease

Reference	Year	No. of patients	Follow-up	Diagnosis	First admission		Second admission	
					All operations	Emergency operations	Recurrence	Emergency operations
Parks ⁷	1969	455	1–16 years‡	BE, path.	138	Most	78*	20
Larson <i>et al.</i> ⁴¹	1976	132	9.2 years§	BE, path.	33	n.r.	29†	9
Haglund <i>et al.</i> ²⁸	1979	392	6 years§	BE, path.	97	97	73	0
Ambrosetti <i>et al.</i> ⁴⁰	1994	226	25 months#	CT, CE	66	n.r.	42	8
Ambrosetti <i>et al.</i> ⁴²	1997	423	46 months#	CT, CE	112	33	27	n.r.
Makela <i>et al.</i> ³⁷	1998	366	10 years#	CE, path.; colonoscopy	101	55	57	19
Biondo <i>et al.</i> ⁴³	2002	327	24–90 months‡	CE, CT, path.	103	78	52	4

*Twelve patients readmitted with a third attack and five with a fourth attack; †17 patients readmitted with a third attack and 11 with a fourth attack; ‡range, §mean, #median. BE, barium enema; path., pathological confirmation; CT, computed tomography; CE, contrast enema; n.r., not recorded.

Table 3 Studies of the natural history of complicated diverticular disease

Reference	Year	No. of patients	Follow-up§	Conservative management		Readmission		Surgery		Died from unrelated cause
				Total	Died	Total	Died	Total	Died	
Sarin and Boulos ⁴⁸	1994	164*	48 months	86	1	13	n.r.	52 (31)	6	39
Faramakis <i>et al.</i> ¹²	1994	120	5 years	43	9†	15‡	8	77 (n.r.)	1	29
Elliott <i>et al.</i> ⁴⁹	1997	403	5 years	185	3	55	7	113 (103)	20	n.r.

Values in parentheses are number of urgent operations. *Excluded fistulas; †death was attributed to recurrence of complicated diverticular disease identical to the initial presentation, but not managed surgically during the initial episode (possibly because patients were originally unsuitable for resection); ‡24 patients had recurrent complicated diverticulitis treated at home, of whom two died; §median. n.r., not recorded.

had recurrence and the trial was abandoned. Thus few prospective, single-institution reports are available on the natural history of complicated diverticulitis.

In a retrospective analysis of complicated diverticular disease, Sarin and Boulos⁴⁸ reported a recurrence rate of only 2 per cent per patient-year of follow-up, postulating that advances in antimicrobial chemotherapy may have contributed to resolution of inflammation and more successful medical management than that described in older studies. They highlighted difficulties in achieving complete follow-up in an elderly population, 30 per cent of whom died from unrelated causes during a median follow-up of 4 years⁴⁸. Others report similar findings^{12,28,37}. It appears that most patients recover from the initial attack without further complication. The probability of readmission diminishes with each subsequent attack, and there is limited evidence to suggest that these patients are more likely to suffer complications.

Elective resection to prevent complications of diverticular disease

Large case series show that the mortality rate associated with emergency operation is 12–36 per cent^{48,49,51–56}. Mortality rates have not changed over the past two

decades, despite advances in antibiotic therapy, surgical techniques and intensive care^{57,58}. Elective resection to prevent complications of diverticular disease is based on the assumption that, without surgical management, complications are more likely to occur. Consequently, it follows that without elective surgery a high proportion of patients with recurrent symptoms will require urgent operations for complicated diverticular disease. If this were true a high proportion of those undergoing surgery for complicated diverticular disease would be expected to have a history of previous attacks. However, objective evidence of this is lacking, and results from centres in which prophylactic resection is avoided suggest the opposite (*Table 4*).

Early studies suggested that 68–73 per cent of patients operated on for diverticular abscess or free perforation had no previous symptoms of diverticular disease^{55,62}. More recently, Lorimer⁶⁰ retrospectively reviewed 154 consecutive patients admitted with complicated acute diverticulitis, 82 per cent of whom underwent emergency operation. Only 5 per cent had a previous admission related to diverticular disease, and there were no postoperative deaths in this group despite an overall operative mortality rate of 9 per cent. Lorimer questioned the role of prophylactic resection, suggesting that it was unlikely to

Table 4 Studies that retrospectively assessed how many patients requiring urgent surgery had a history of diverticular disease

Reference	Year	No. of patients	Elective surgery	Emergency surgery		Follow-up (years)
				All patients	Patients with previous diverticular disease	
Alexander <i>et al.</i> ³²	1983	673	13	80	37	10
Nylamo ⁵⁹	1990	113	3	48	2	10
Lorimer ⁶⁰	1997	392	28	126	15*	8
Somasekar <i>et al.</i> ⁶¹	2002	108†	0	104	28*	5

*Only eight patients in these studies required admission to hospital for diverticular disease; †complicated diverticular disease only.

prevent late complications because so few of those treated for complications had a history of diverticulitis.

Nylamo⁵⁹ reported an operative mortality rate of 17 per cent among 48 patients undergoing emergency surgery for complicated diverticular disease. Although the operative mortality rate was high, 96 per cent of patients had no history of diverticular disease, suggesting that prophylactic resection would have had little impact in preventing severe complications. Interestingly, during the same study period 57 patients underwent conservative treatment, with 42 per cent suffering recurrence during 10 years' follow-up⁵⁹. Despite the high recurrence rate, no complications occurred.

In another study complicated diverticular disease occurred *de novo* in the majority of patients⁶¹. Only 26 per cent had a history of diverticular disease before presenting with complications. A cross-sectional population-based study estimated the incidence of perforated diverticulitis at four cases per 100 000 population per annum, with less than one-quarter of patients having a history of diverticular disease⁶³. This fraction is in agreement with other studies with a lower mortality rate and fewer perforations (*Table 4*), suggesting that complications and operative mortality occur independently of a history of diverticular disease. Even in the presence of complicated diverticular disease, only 36 per cent of complications are the same as the initial event¹².

Meaningful comparison of these studies is limited by differences in patient selection, methodology, geographical variation and diagnostic criteria. However, one can deduce that offering elective resection would have little impact on the incidence of patients requiring emergency procedures, and that for most patients a complication of diverticular disease is the first manifestation of disease. After reviewing the data from heterogeneous studies with varying, but adequate, follow-up information^{28,40,42,64,65}, the authors estimate that one patient per 2000 patient-years of follow-up will require an urgent Hartmann's resection after resolution of an episode of diverticulitis. The idea that patients should undergo elective resection to avoid a

colostomy bag is incorrect; such a concept can scare patients into elective surgery.

What is 'symptomatic diverticular disease'?

Many studies have investigated heterogeneous patient groups by using vague categories such as 'symptomatic diverticular disease' or by incorporating patients with chronic abdominal symptoms within the complicated diverticular disease group. The resulting cohorts are incomparable, making it difficult to draw firm conclusions. Furthermore, studies quoting recurrence rates often fail to specify how recurrence was diagnosed. Consequently, a readmission with lower abdominal pain may be recorded as recurrent disease, artificially enhancing the recurrence rate.

Relationship between histology and symptoms

Histological analysis of resected specimens indicates that 14–33 per cent of patients undergoing elective surgery for diverticular disease have no evidence of inflammation or other complication of diverticular disease^{66–71}. The relationship between symptoms and histological findings is complex, and an absence of inflammation does not preclude a previous diagnosis of diverticulitis⁸. Determining the temporal relationship between clinical and histological inflammation is complicated by the interval associated with elective resection.

Histological studies have demonstrated severe inflammation despite resolution of symptoms following admission for complicated diverticulitis⁷², whereas others report low-grade inflammatory changes in chronic diverticular disease without fever or neutrophilia⁷³. Horgan *et al.*⁷³ reported a weak association between endoscopic and histological findings; only 13 per cent of patients undergoing resection for symptomatic diverticular disease had endoscopic evidence of diverticulitis, although 76 per cent of resected specimens showed histological evidence of inflammation.

They also noted a poor correlation between endoscopic findings and symptoms⁷³.

Microperforation may be present in most situations of acute diverticulitis and so inflammation may be confined to pericolonic tissue, although the colonic mucosa appears grossly and microscopically normal⁷⁰. These features suggest that decisions regarding treatment of diverticulitis should not be based on endoscopic findings alone. Studies reliant on endoscopic evidence of diverticulitis without computed tomographic confirmation should be interpreted with caution.

When a surgeon recommends elective surgery to a patient who has completely recovered from an episode of diverticulitis, he or she must be proposing that the patient has a diverticulum of a virulent 'class' or a 'rogue' diverticulum, either of which is different from diverticula most people have, that will continue to cause complications and should be removed. At present there is no evidence supporting either contention. Indeed, there is evidence that once a patient definitely recovers from an episode of diverticulitis, his or her risk of suffering diverticulitis approximates to that of the general population with diverticulosis²⁸.

Outcome in relation to histology

Conflicting results indicate a weak association between histological and clinical findings. A few studies have recognized these difficulties in patient selection and stratified their results accordingly. Breen *et al.*⁶⁶ reviewed 100 consecutive elective resections for presumed diverticular disease, demonstrating that 24 per cent of resected specimens had no histological evidence of inflammation, acute or chronic. During a mean follow-up of 37 months, 60 per cent of patients with no inflammation experienced a range of continuing symptoms, whereas only 15 per cent of those with inflammation were symptomatic during follow-up. Patients symptomatic for more than 1 year before surgery were also significantly less likely to be asymptomatic during follow-up, consistent with Parks' data⁷.

Moreaux and Vons⁷¹ reported similar findings in a 21-year retrospective review of 177 operations for complicated diverticular disease. Patients without histological evidence of inflammation were seven times more likely to experience persistent postoperative pain and twice as likely to have recurrent 'diverticulitis' than those with inflammation. Irritable bowel syndrome associated with diverticular disease was thought to account for the high proportion of unsatisfactory results⁷¹. Thorn *et al.*⁶⁷ confirmed this hypothesis by means of a retrospective postoperative questionnaire. The outcome was significantly worse for

those with preoperative functional symptoms, or symptoms suggestive of irritable bowel syndrome. Although these conclusions are limited by potential recall bias and lack of pathological data, they highlight the importance of obtaining a detailed history of functional bowel habit. This facilitates differentiation from patients with irritable bowel syndrome, who are unlikely to benefit from surgical intervention.

Irritable bowel syndrome

Considerable overlap exists between symptoms of diverticular disease and irritable bowel syndrome. Consequently, without histological confirmation individuals from the latter group may be erroneously included within the former. Further confusion arises when the conditions coexist. Depending on diagnostic criteria, the prevalence of irritable bowel syndrome is 7–16 per cent in Western society⁷⁴, and at least 14 per cent in patients with diverticular disease⁷⁵. Consequently a number of individuals may have symptoms attributable to both conditions. Following resection for histologically proven diverticulitis, up to 27 per cent of patients experience ongoing abdominal pain, probably reflecting coexisting irritable bowel syndrome²³. The temporal relationship between these distinct entities remains controversial. Although irritable bowel-like symptoms may follow an episode of diverticulitis⁷⁵, evidence of the reverse is lacking, despite an early theory suggesting a relationship⁷⁶.

The wide spectrum of diverticular disease, coupled with selection bias, limits comparison of retrospective studies. Despite methodological differences, there is consensus that patients lacking inflammatory changes in resected specimens tend to have a worse outcome. These patients should be aware that surgery may not relieve their symptoms^{23,67}. There is a shortage of well designed prospective studies that account for overlapping symptoms of irritable bowel syndrome and that report histological data.

Diverticulitis in young patients

Diverticulitis in the young is traditionally considered a distinct entity. The results of published series of diverticular disease in young patients are summarized in Table 5. Post-mortem series of unselected patients have demonstrated diverticula from the second decade of life, with diverticular disease present in 6 per cent by 40 years of age⁹² and 9–12.2 per cent by 50 years of age^{92,93}. The true incidence of diverticulosis in this age group remains unknown because the majority are asymptomatic.

Table 5 Studies of diverticular disease in the young

Reference	Year	No. of patients	Age (years)	Misdiagnosis	Urgent surgery	Urgent surgery for incorrect diagnosis
Eusebio and Eisenberg ⁷⁷	1973	181	≤ 40	56 (30.9)	34 (18.8)	7
Simonowitz and Paloyan ⁷⁸	1977	33	< 40	24 (73)	6 (18)	5
Chodak <i>et al.</i> ⁷⁹	1981	37	≤ 40	22 (59)	20 (54)	9
Ouriel and Schwartz ⁶⁴	1983	92	< 40	47 (51)	16 (17)	5
Freischlag <i>et al.</i> ⁸⁰	1986	17	< 40	8 (47)	15 (88)	2
Schauer <i>et al.</i> ⁸¹	1992	61	≤ 40	25 (41)	44 (72)	25
Acosta <i>et al.</i> ⁸²	1992	17	≤ 40	n.r.	7 (41)	n.r.
Konvolinka ⁸³	1994	29	< 40	15 (52)	16 (55)	11
Ambrosetti <i>et al.</i> ⁸⁴	1994	61	< 50	n.r.	9 (15)	n.r.
Vignati <i>et al.</i> ⁸⁵	1995	40	< 50	n.r.	10 (25)	n.r.
Spivak <i>et al.</i> ⁸⁵	1997	63	< 45	28 (44)	22 (35)	12
Cunningham <i>et al.</i> ⁸⁶	1997	32	< 40	n.r.	14 (44)	3
Marinella and Mustafa ⁸⁷	2000	21	< 40	10 (48)	6 (29)	4
Minardi <i>et al.</i> ⁸⁸	2001	22	≤ 40	13 (59)	12 (55)	7
Biondo <i>et al.</i> ⁴³	2002	72	≤ 50	n.r.	19 (26)	n.r.
Schweitzer <i>et al.</i> ⁸⁹	2002	46	≤ 40	13 (28)	16 (35)	13
Greenberg <i>et al.</i> ⁹⁰	2003	50	≤ 40	n.r.	20 (40)	n.r.
West <i>et al.</i> ⁹¹	2003	46	< 50	3 (7)	19 (30)	2

Values in parentheses are percentages. n.r., not recorded.

Young patients comprise 2–29 per cent of all patients with diverticular disease^{64,77,80,82,94}, with higher proportions reflecting studies examining acute diverticulitis rather than all diverticular disease^{80,82}. These figures may be an underestimate, as not all young patients with abdominal pain undergo investigation for diverticulitis⁶⁴.

It is unclear whether young patients are at an increased risk of complications or recurrent attacks following successful medical management of the first episode. Overall, risk may simply reflect prolonged exposure to diverticular disease rather than a change in disease virulence. Diverticular disease may not be more virulent in the young, but clinical experience may be of the more severely affected owing to missed diagnoses, late presentation and delayed diagnosis. Fortunately, resection for recurrent disease in the young is associated with minimal mortality⁷⁹, suggesting that a conservative approach may initially be justified.

Management of diverticulitis in young patients remains controversial. Although early studies described a more aggressive course, recent data suggest that this may not be so. The natural history has not been clearly defined; increased risk may be a chronological rather than pathological phenomenon. Selection bias, misdiagnosis and delayed diagnosis undermine conclusions regarding management in this age group. Well designed prospective studies are required to determine whether diverticulitis in the young requires early intervention. At present there is little evidence to support such a recommendation.

Conclusion

There is inadequate evidence to suggest that complications are more likely to occur with each successive hospital admission, or that the likelihood of a successful response to medical treatment decreases. Moreover, for most patients a complication of diverticular disease is the first manifestation of pathology. Despite an increase in both the prevalence of diverticular disease and the associated surgical intervention rate, the practice of evidence-based management is not widespread.

The retrospective nature of the literature means that one does not know the true effect of patient selection on outcome. Conclusions based on inconsistent study outcomes are not sufficient to justify a potentially unnecessary surgical procedure, with its associated morbidity and mortality. In addition, few studies have accounted for the overlapping symptoms of diverticular disease and irritable bowel syndrome. This may partly explain the high rate of persistent symptoms in some groups, despite resection of presumed diverticular disease. Patients should be informed that their symptoms might persist after operation.

Well designed prospective trials with homogeneous results are obligatory if specific recommendations are to be made about the optimum management of recurrent diverticular disease. The present inconsistent nature of the available data should be appreciated when considering studies of diverticular disease; management guidelines based on such studies should be interpreted with caution.

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