

**WHAT IS ALREADY KNOWN ON THIS TOPIC**

Hypertension is a major public health problem globally  
 Doctors in Pakistan have been shown to have serious gaps in knowledge of and approach to treatment of patients with hypertension  
 Lack of adherence to antihypertensive drugs contributes to poor rates of blood pressure control

**WHAT THIS STUDY ADDS**

Special training of general practitioners with a simple educational package on management of hypertension led to significantly improved adherence among communities in Pakistan  
 Simple interventions emphasising good communication between doctors and patients should be adopted by other developing countries

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## Mortality in patients with and without colectomy admitted to hospital for ulcerative colitis and Crohn's disease: record linkage studies

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**ABSTRACT**

**Objective** To compare mortality outcomes in the three years after elective colectomy, no colectomy, and emergency colectomy among people admitted to hospital for inflammatory bowel disease, to inform whether the threshold for elective colectomy in clinical practice is appropriate.

**Design** Record linkage studies.

**Setting** Oxford region (1968-99) and England (1998-2003).

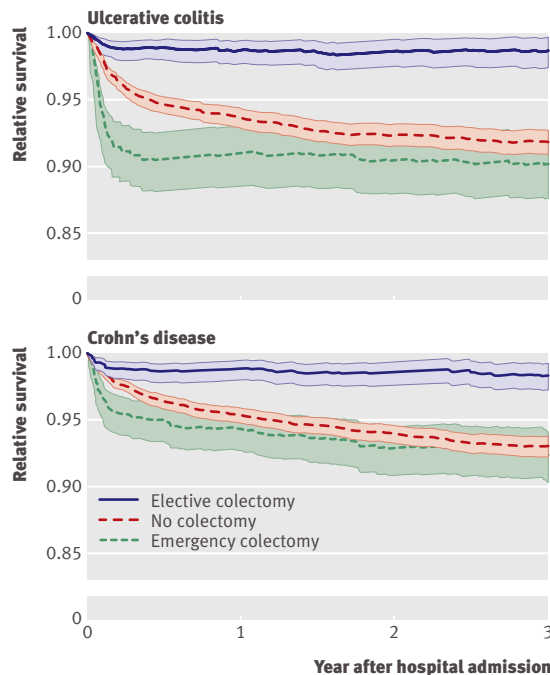
**Participants** 23 464 people with hospital stay for more than three days for inflammatory bowel disease, including 5480 who had colectomy.

**Main outcome measures** Case fatality, relative survival, and standardised mortality ratios.

**Results** In the Oxford region, three year mortality was lower after elective colectomy than after either no

colectomy or emergency colectomy, although this was not significant. For England, mortality three years after elective colectomy for ulcerative colitis (3.7%) and Crohn's disease (3.3%) was significantly lower than that after either admission without colectomy (13.6% and 10.1%; both  $P < 0.001$ ) or emergency colectomy (13.2% and 9.9%;  $P < 0.001$  for colitis and  $P < 0.01$  for Crohn's disease). Three or more months after elective colectomy, mortality was similar to that in the general population. Adjustment for comorbidity did not affect the findings.

**Conclusions** In England, the clinical threshold for elective colectomy in people with inflammatory bowel disease may be too high. Further research is now required to establish the threshold criteria and optimal timing of elective surgery for people with poorly controlled inflammatory bowel disease.



Relative survival during three years after elective colectomy, emergency colectomy, and no colectomy in England (1998-2000) for patients admitted for ulcerative colitis and for Crohn's disease, adjusted for age and sex and compared with general population. Survival in general population is 1. Shaded areas are 95% confidence intervals

## INTRODUCTION

About 35 000 colectomies are carried out annually in England,<sup>1</sup> and about 2000 people undergo colectomy for inflammatory bowel disease each year. We compared mortality after elective colectomy with that after hospital stay with no colectomy or emergency colectomy.

## METHODS

We compared mortality after colectomy (elective, emergency, or none) for people admitted to hospital for inflammatory bowel disease, using the Oxford record linkage study.<sup>2</sup> We investigated admissions to hospital and numbers of colectomies (1968-96) in the Oxford region, with follow-up of deaths to 1999, and we then carried out a larger analysis using new record linkage for England (1998-2000), with follow-up of deaths to March 2003.

We included people admitted for inflammatory bowel disease when coded as the main diagnosis and for colectomy when recorded in any field for operational procedures on hospital discharge records (see [bmj.com](http://bmj.com) for coding).

We included all types of admissions except patients who were admitted as day cases, as they usually require elective endoscopy only. For patients who did not undergo operation we first excluded those with hospital stay of less than four days, as they probably had less severe disease, and then we repeated the

analyses with them. We followed relevant patients in the Oxford region for three years after admission and followed patients with subsequent admissions for a further three years. For England we selected each patient's first admission and followed them for three years. We categorised colectomies as elective or emergencies. We also identified major comorbidities (see [bmj.com](http://bmj.com)) from secondary diagnoses on patients' records.

## STATISTICAL ANALYSIS

We calculated case fatality rates using the number of colectomies and hospital admissions for inflammatory bowel disease as the denominators and subsequent deaths from any cause as the numerators. When comparing case fatality between the patients who underwent elective colectomy, no colectomy, and emergency colectomy we split the three years of follow-up into several intervals: one month, 2-3 months, 4-6 months, and 7-36 months.

To compare mortality in each group of patients with that in the corresponding general populations of the Oxford region and England, we calculated standardised mortality ratios using the indirect method. We calculated cause specific standardised mortality ratios from the underlying cause of death on the death certificates, using data from the Oxford region; data on cause of death were not available for the England study. We used multiple logistic regression to adjust case fatality for age, sex, and major comorbidities.

We calculated the relative survival during the three years after colectomy as the ratio of the observed survival in surgical patients, and those admitted to hospital without surgery, to the expected survival in the corresponding general populations, adjusted for age, sex, and period.

## RESULTS

The study population comprised 23 464 people from the record linkage studies in Oxford (1968-99) and England (1998-2003) admitted to hospital for more than three days for inflammatory bowel disease (see [bmj.com](http://bmj.com)). The table summarises the case fatality rates at three years for both populations. The figure shows the relative survival after elective or emergency colectomy or no colectomy for patients with ulcerative colitis or Crohn's disease in England.

In the Oxford region, case fatality at three years (table) and relative survival after elective colectomy for both diseases (see [bmj.com](http://bmj.com)) were better than after no colectomy or emergency colectomy (table); this did not, however, reach statistical significance.

In England, case fatality at three years (table) and relative survival after elective colectomy for both diseases (figure) were significantly better than after no colectomy ( $P < 0.001$  for both). Case fatality at three years and relative survival were also significantly better after elective colectomy than after emergency colectomy (ulcerative colitis  $P < 0.001$ , Crohn's disease  $P < 0.01$ ). These differences across the groups remained

Number of hospital admissions, deaths, and case fatality rates three years after admission for ulcerative colitis or Crohn's disease in patients who underwent elective, emergency, or no colectomies in Oxford region (1968-96) and England (1998-2000)

Study region: type of admission	Ulcerative colitis			Crohn's disease		
	No of admissions	No of deaths at 3 years	Case fatality(95% CI) at 3 years (%)	No of admissions	No of deaths at 3 years	Case fatality (95% CI) at 3 years (%)
Oxford region:						
Elective colectomy	231	14	6.1 (3.4 to 10.0)	345	16	4.6 (2.7 to 7.4)
Emergency colectomy	246	24	9.8 (6.4 to 14.2)	271	25	9.2 (6.1 to 13.3)
No colectomy	2476	315	12.7 (11.4 to 14.1)	2336	229	9.8 (8.6 to 11.1)
All admissions*	2959	355	12.0 (10.9 to 13.2)	2958	271	9.2 (8.1 to 10.3)
England†:						
Elective colectomy	1198	44	3.7 (2.7 to 4.9)	1362	45	3.3 (2.4 to 4.4)
Emergency colectomy	785	104	13.2 (11.0 to 15.8)	1030	102	9.9 (8.2 to 11.9)
No colectomy	6262	854	13.6 (12.8 to 14.5)	6910	697	10.1 (9.4 to 10.8)
All admissions	8245	1002	12.2 (11.5 to 12.9)	9302	844	9.1 (8.5 to 9.7)

\*In Oxford region not recorded whether colectomy was elective or emergency in six people who underwent colectomy for ulcerative colitis and six who underwent colectomy for Crohn's disease.

†When patients with short inpatient stays of 1-3 days were included in England study case fatality rates were similar at three years for elective, emergency, and no colectomy for patients with ulcerative colitis (3.7%, 13.4%, and 11.8%) and with Crohn's disease (3.3%, 9.9%, and 8.2%).

similar when patients with short stays (1-3 days) were included.

For people who underwent emergency colectomy the risk of death was increased substantially in the first four to six months after operation for ulcerative colitis (figure). For ulcerative colitis, after about two months following elective colectomy and after about four months following emergency colectomy, mortality levelled off to that in the general population of equivalent age (figure).

For Crohn's disease, survival decreased in the two months after surgery; mortality after elective colectomy then levelled off at the rate of that in the general population (figure). The survival of people with Crohn's disease who had emergency colectomy continued to worsen throughout much of the three years of follow-up when compared with that in the general population. In people with either disease who did not undergo colectomy, mortality was worse than that in the general population throughout the three years of follow-up (table and figure).

In the England study, significant differences were found in case fatality between the elective and no colectomy groups for ulcerative colitis during each follow-up interval within the three years and between the elective and emergency colectomy groups up to three months (see [bmj.com](#)). For Crohn's disease, significant differences in case fatality were found between the elective and no colectomy groups at two months and subsequently up to three years of follow-up, and between the elective and emergency colectomy groups at three months and at 7-36 months.

#### Adjusting for comorbidities

Adjusting for major comorbidities made little difference to the finding of increased mortality after emergency colectomy and no colectomy compared with elective colectomy (see [bmj.com](#)). The increased odds of mortality for patients after elective colectomy

compared with no colectomy was unchanged after adjusting for comorbidities in those with ulcerative colitis (2.18), and the odds was marginally reduced in those with Crohn's disease (2.51 to 2.49). For elective colectomy compared with emergency colectomy the increased odds for the emergency colectomy group fell slightly for patients with either disease (ulcerative colitis, 3.28 to 3.04; Crohn's disease, 2.86 to 2.68). When patients with short stays of 1-3 days were included, with inflammatory bowel disease presumed to be less severe, mortality across the three groups were similarly unaffected by comorbidities (see [bmj.com](#)).

#### Mortality from intestinal disease

Of 544 deaths within three years after no colectomy in the Oxford region, almost one third (165; 30.3%) resulted from intestinal disease. The cause specific standardised mortality ratios at three years for Crohn's disease, among people admitted for Crohn's disease in the Oxford region, was 1750 (95% confidence interval 1345 to 2209; 63 deaths, compared with a standardised mortality ratio of one in the general population). The corresponding values for mortality from ulcerative colitis, among people admitted for ulcerative colitis, were 648 (487 to 833, 54 deaths).

#### Subsequent colectomy after an admission with no colectomy

In England, of those who initially did not undergo colectomy, 9.9% of those with ulcerative colitis and 4.5% of those with Crohn's disease underwent subsequent colectomy. For patients with ulcerative colitis who initially did not undergo colectomy, case fatality was 11.8% for those who subsequently had colectomy and 13.8% for those who did not. For Crohn's disease, case fatality was almost identical (10.0% and 10.1%) for those who did or did not subsequently undergo colectomy. The results were similar for patients admitted for short or longer stays (table).

## DISCUSSION

Three year mortality was significantly lower among people after elective colectomy for inflammatory bowel disease than among those admitted to hospital without colectomy or who had emergency colectomy. Our findings suggest that the threshold for elective colectomy in England may be too high.

The main strengths of this study were its scale and that it was undertaken in two geographically defined populations. The study utilised two record linkage studies that are unique in England—the Oxford record linkage study and the new English record linkage. The two cover different periods. Our first study was undertaken for the Oxford region, and its main findings—improved long term mortality for patients admitted for inflammatory bowel disease who underwent elective colectomy compared with emergency colectomy or no colectomy—led us to investigate this further in the study of England. The findings of the Oxford study were confirmed, with a high level of statistical significance.

The main limitations of these studies are a lack of detailed information about the history, severity, and management of diseases. Thus we were unable to fully ascertain disease severity in the groups studied. When we adjusted for inpatient comorbidity, using secondary diagnoses from the routine inpatient data, the finding of lower mortality after elective colectomy compared with no colectomy was scarcely altered, indicating that this finding cannot be attributable to case mix. The most likely explanation is that the higher mortality among patients who had no colectomy would have been reduced if planned colectomy had been undertaken on some of the patients, particularly as almost one third of deaths in the Oxford region in the three years after admission without colectomy were from intestinal disease.

We chose mortality after at least four days' hospital stay as the main analysis as we wanted to exclude patients with mild disease. The findings were not altered when we included patients with short stays (1-3 days).

### WHAT IS ALREADY KNOWN ON THIS TOPIC

Many people with severe inflammatory bowel disease will require colectomy at some stage and emergency colectomy carries a significant risk

Mortality after elective colectomy is quite low, at least in the short term, but longer term follow-up data are lacking

### WHAT THIS STUDY ADDS

Three year mortality among people admitted for inflammatory bowel disease is significantly better after elective colectomy than after no colectomy or emergency colectomy

At three years the increased risk of mortality in people who did not undergo colectomy is almost as high as that in people after emergency colectomy for inflammatory bowel disease

This is strong evidence suggesting that the threshold for elective colectomy is too high

Our study highlights the increased mortality after emergency colectomy and also documents the longer term outcomes with and without surgery. For both forms of inflammatory bowel disease we found that three year survival was improved among people after elective colectomy, and that the short term increased risks of mortality after elective surgery were confined to the two months after emergency colectomy. After the postoperative period, survival after elective colectomy for ulcerative colitis and for Crohn's disease became similar to that in the general population. Also, as quality of life is normally improved after surgery,<sup>3</sup> this illustrates further that, whenever indicated and possible, it is preferable for colectomy to be undertaken electively rather than risk the need for emergency surgery with its poorer prognosis.

Although mortality after emergency surgery for ulcerative colitis was initially higher than that in the general population, it returned to the level of the general population within a few postoperative months; this was not the case after emergency colectomy for Crohn's disease. This probably reflects the curative nature of successful surgery for ulcerative colitis, whereas such a cure cannot be achieved for Crohn's disease.

The threshold for elective colectomy for inflammatory bowel disease in England may be too high. About 15% of people with ulcerative colitis have a severe attack and require admission to hospital.<sup>4</sup> Of these, about 40% undergo colectomy. It has been recommended that about 85% of those who do not respond to treatment within three days should undergo colectomy.<sup>5,6</sup> To delay surgery further carries risks.<sup>5,7</sup> Our findings indicate that the threshold for surgery should probably be lower, as recovery is still associated with an increased mortality at three years. Further research is required to establish the criteria for threshold and optimal timing for colectomy in people with poorly controlled inflammatory bowel disease.

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