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Morbidity and Mortality after Emergency and Urgent Colorectal Surgery for Malignant and Benign Disease

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Abstract: *Aim:* The aim of this study was to determine short and long-term morbidity and mortality rates after emergency colorectal surgery for benign and malignant disease in a high volume tertiary referral hospital in order to define factors predictive for outcome.

Material and Methods: Characteristics and outcome of 196 consecutive emergency and 292 consecutive elective colorectal procedures were studied. A total of 91/196 emergency procedures were performed for malignant disease. The procedures reviewed included both palliative and curative procedures performed on an unselected patient population. Results were analysed by Cox regression and Kaplan-Meier analysis.

Results: The total 30-day mortality for emergency and elective surgery was 20% and 3 % respectively, 36-month mortality was 48% and 27%. The frequency of major or moderate complications after emergency procedures was 39%.

The strongest predictors for 30 day mortality after emergency surgery were ASA score (Odds Ratio 2.5) and age (OR 1.5). Predictors for early postoperative complications were faecal contamination during surgery (OR 4.2) and ASA score (OR 2.0). The strongest predictor for 3 year mortality after emergency surgery was malignant disease (OR = 5.0). Other predictors for long-term outcome were procedures performed and degree of specialization of the surgeon.

Conclusions: Short-term outcome is associated with patient and disease related factors, whereas long-term outcome is also correlated to the primary diseases, procedures performed and the degree of specialization of the surgeon. Decisions concerning the level of qualifications required for emergency procedures should be based upon patient and disease related factors as well as the procedure to be performed.

Key Words: Emergency, urgent, outcome, colorectal surgery.

INTRODUCTION

Urgent and emergency colorectal surgery is being offered to a wide range of patients with curative or palliative intention. The disease can be malignant or benign of nature.

The complication rate after urgent and emergency colorectal surgery is high due to the nature of the diseases, the surgical procedures performed and patient related factors such as high age and co morbidity [1-6].

The most important predictors of complications found in previous reports were patient related, in particular co morbidity [7, 8].

There are few data on long-term outcome for the patients surviving the first 30 postoperative days after urgent and emergency colorectal surgery.

In addition most reports regarding outcome focused on either diagnostic entity or procedural entity and thus making it difficult to determine the overall operative risk for patients requiring emergency colorectal surgery [9-13].

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The aim of this study was to determine short and long term morbidity and mortality after emergency colorectal surgery for benign and malignant disease in a high volume tertiary referral hospital in order to define predicting factors for both short and long-term outcome in an unselected patient population.

MATERIALS AND METHODOLOGY

All 196 consecutive patients admitted between 1st January 2002 to 30th June 2003, and subject to urgent or emergency colorectal surgery at Haukeland University Hospital were extracted from the hospital databases and retrospectively analysed.

Urgent surgery is defined as surgery within 24 hours and emergency surgery as procedures performed within 2 hours from admission to our unit.

All patients are registered electronically on arrival in the patient administrative systems (Doculive and Patient Information Management System (PIMS)) if they are hospitalized for more than 6 hours or if they are transferred from other departments to our unit. All surgical procedures are registered as elective or urgent/emergency in an electronic program for planning and registration of surgical procedures

1876-8202/09

(Orbit). The NOMESCO code ZXD00 (emergency or urgent) was combined with the NOMESCO codes JFB, JFC, JFD, JFF, JFH and JGB (colorectal surgery). The 30-day and 3-year mortality were extracted from the Norwegian National Registry. The completeness of registration in all 4 systems is > 99%.

For comparison, consecutive, elective patients receiving colorectal surgery (identical NOMESCO codes) during the same period of time (292 patients), were studied.

Only procedures requiring laparotomy were included. Appendectomies and other minor procedures were not included. If multiple procedures were performed, the most exhaustive procedure was registered.

All eligible patients identified in ORBIT were cross-checked in Doculive. Nine patients were excluded, four due to error of registration as emergency cases, one due to registration error of identity and four due to procedure code error.

Data extracted from Orbit included sex, age, ASA (American Society of Anaesthesiologists)-score, time of day when procedure was performed, CEPOD (confidential enquiry into peroperative deaths) and procedure code. The ASA score is registered by the anaesthetist preoperatively and the procedure code by the surgeon immediately postoperatively.

The nature of disease (benign or malignant), the presence of peritonitis and/or ileus, faecal contamination, intraoperative perforation of intestine, type of procedure and if resection and/or primary anastomosis or stoma procedure was performed, the qualifications of the primary surgeon (resident, general surgeon/sub specialised surgeon in a speciality different from colorectal surgery, sub specialized colorectal surgeon) and admittance to the ICU during hospital stay were extracted from Doculive.

Complications are registered for all patients on discharge in a general electronic formula. These data were cross-checked by manual search in the patients' journals. The retrospective identification of minor complications was considered unreliable and only major and moderate complications were registered in this study.

Statistical Analysis

To study potential relationships between pre- per- and postoperative factors and morbidity and mortality, univariant chi square analyses were used. The significant or near significant ($p < 0.07$) outcomes were then tested in multivariate analyses using a Cox binary logistic regression, backward stepwise method. Survival was estimated by Kaplan-Meier analyses.

SPSS for Windows version 14.0 (SPSS, Chicago, IL) was used to analyze the data.

RESULTS

One hundred and ninety-six (196) emergency and urgent patients were included, 107 (55%) males and 89 (45%) females. The mean age was 65 years (range 15-96 years), median 71 years. Minimum follow up was 36 months, median 43 months.

The procedures performed are listed in Table **1**.

Total morbidity rate in urgent and emergency patients was 39 % (77/196).

Those with possible correlation to mortality after the Chi Square analysis were apoplexy, anastomotic leakage, acute myocardial infarction, wound rupture, bleeding leading to reoperation, respirator treatment and sepsis.

The 30 days mortality rate in emergency and urgent procedures was 20 %, and 36 months mortality was 48 %.

Independent variables included into the Cox analysis were malignancy, ASA score, age, faecal contamination, primary anastomosis, Hartmann's procedure, resection of intestine, time of day for surgery and qualifications of primary surgeon. Significant predictors for 30 days and 3 years mortality are shown in Table **2**.

Eight out of 292 (3 %) elective patients died within 30 days from the surgery and the 36 months mortality was 27 % (78/292).

No correlation between death and age or death and gender was found with respect to 30 days mortality among the elective patients, but the number of deaths was small.

The distribution of diseases and procedures in the elective patients differed from those of urgent/emergency operations with 61% cancer patients and 37% major rectal surgery, whereas the urgent/emergency group included 46% patients with cancer and 7% who had major rectal surgery.

Cox Analysis

Morbidity

The multivariant analysis did not show significant correlation between any individual complication and mortality, at

Table 1. Registration of Procedures Performed

	Number of Patients (%)	Complications (%)	Death 30 Days (%)	Deaths 3 Years (%)
Resection of intestine	144 (74)	55 (38)	25 (17)	61 (42)
Primary anastomosis	114 (58)	44 (39)	22 (19)	55 (48)
Hartmann procedure	21 (11)	9 (43)	3 (14)	8 (38)
Stoma	58 (30)	16 (28)	14 (24)	32 (55)

The total number exceeds 196 (100%) because some patients had more procedures.

Table 2. Cox Regression Analysis of 30 Day and 3 Year Mortality

Variable		Mort 30 Days	p	Mort 36 Months	p
Age groups	<50	8% (3/38)	0.022	16% (6/38)	<0.001
	50-59	3,6% (1/28)		21% (6/28)	
	60-69	25% (7/28)		54% (15/28)	
	70-79	27% (16/60)		63% (38/60)	
	≥80	31% (13/42)		69% (29/42)	
ASA groups	1&2	8% (6/75)	0.004	28% (21/75)	0.036
	3	24% (24/98)		59% (58/98)	
	4&5	43% (10/23)		65% (15/23)	
Time of day	08-16	17% (12/72)	n.s.	47% (34/72)	n.s.
	16-00	21% (20/97)	(0.686)	51% (49/97)	(0.548)
	00-08	30% (8/27)		41% (11/27)	
Malignancy					
	1. Benign	18% (19/105)	n.s.	28% (29/105)	<0.001
	2. Malignant, local	23% (13/56)	(0.655)	63% (35/56)	
	3. Malignant, distant	23% (8/35)		86% (30/35)	
Resection					
	1. No resection	29% (15/52)	0.028	63% (33/52)	0.005
	2. Resection	17% (25/144)		42% (61/144)	
Complications					
	1. No complication	11% (14/126)	<0.001	42% (53/126)	0.007
	2. Complication	37% (26/70)		59% (41/70)	
Qualification of surgeon					
	1. Trainee	28% (21/74)	n.s.	59% (44/74)	0.033
	2. General surg/sub specialized surg.	19% (8/43)	(0.067)	40% (17/43)	
	3. Sub specialized colorectal surg	14% (11/79)		42% (33/79)	

Parameters selected from the univariate analyses due to significant or near significant correlation ($p < 0.07$) to mortality or morbidity or because of special interest (time of the day).

neither thirty days nor three years. Though, admittance to the intensive care unit was associated with an odds ratio of death of 36 ($p < 0.001$). No correlation was found between the complexity of the procedure and morbidity.

Thirty Days Mortality

The 30 days mortality was significantly correlated to ASA score (odds ratio (OR) = 2.5, p = 0.004, standard error (SE) = 0.2) (Table **2**, Fig. **1**), to age (OR = 1.5, p = 0.02, SE = 0.19) (Table **2**, Fig. **3**), resection versus no resection (OR = 0.4, p = 0.028, SE = 0.46), and to postoperative complications (OR = 5.0 $p < 0.001$) (Table **2**).

The qualifications of the primary surgeon were excluded in the last step of the regression analysis with a p value of 0.067, resulting from the 30-day mortality of 28 % for patients operated by residents, 19 % for patients operated by general surgeons and 14 % for patients operated by colorectal surgeons.

A diverting stoma operation ad modum Hartman was excluded in the last step of the regression analysis with a p value of 0.123.

Time of day for the procedures was divided into daytime (08.00-16.00 h), evening time (16.00-00.00 h) and night time (00.00-08.00 h). The mortality rates were 17 %, 21 % and 30 % respectively, which was not significant in the multivariate analysis.

No correlation was found between the complexity of the procedure and mortality. Intestinal resection with stoma showed a 30-day mortality of 19 % whereas resections with anastomosis were followed by a 30-days mortality of 28 % (ns).

Three Years Mortality

The analysis of factors predictive for three-year mortality was performed as described for 30-days mortality, but with 3-year survival as the independent variable. Significant predictors were ASA score (OR = 1.8, p = 0.036, SE 0.29) (Table **2**, Fig. **1**), age (OR = 2.0, $p < 0.001$, SE 0.168) (Table **2**, Fig. **3**) and malignancy (OR = 5.0, $p < 0.001$, SE 0.29) (Table **2**, Fig. **2**).

Significant procedure related predictors were postoperative morbidity (OR = 3.3, p = 0.007, SE = 0.43), qualifications of the surgeon (OR = 0.8, p = 0.033, SE = 0.12) and

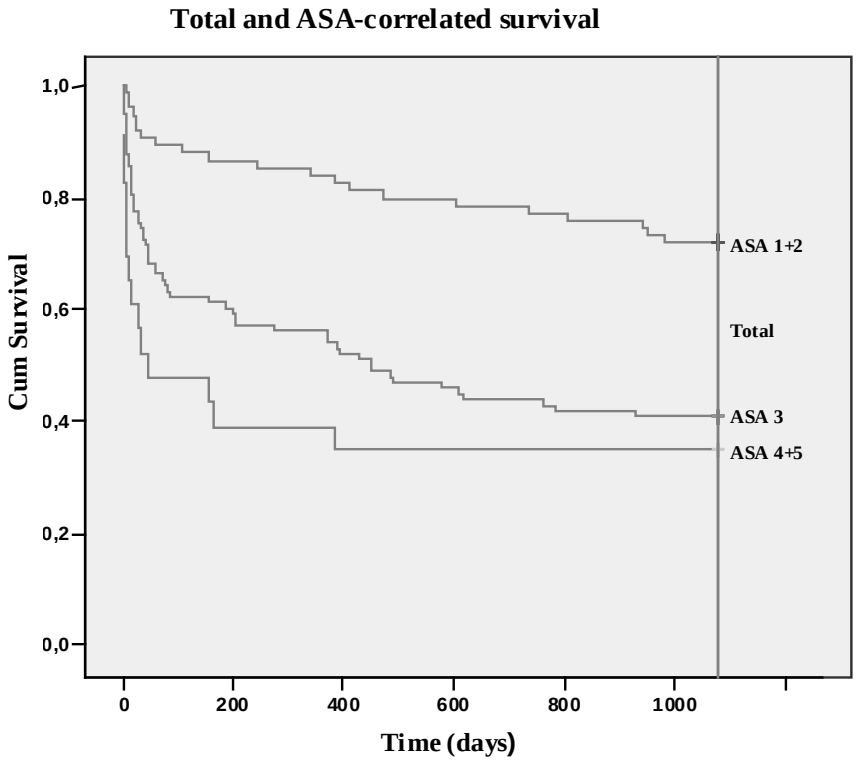

Fig. (1). Survival and ASA score.

Survival curves for ASA 1+2, ASA 3 and ASA 4+5 and for the total patient population are shown.

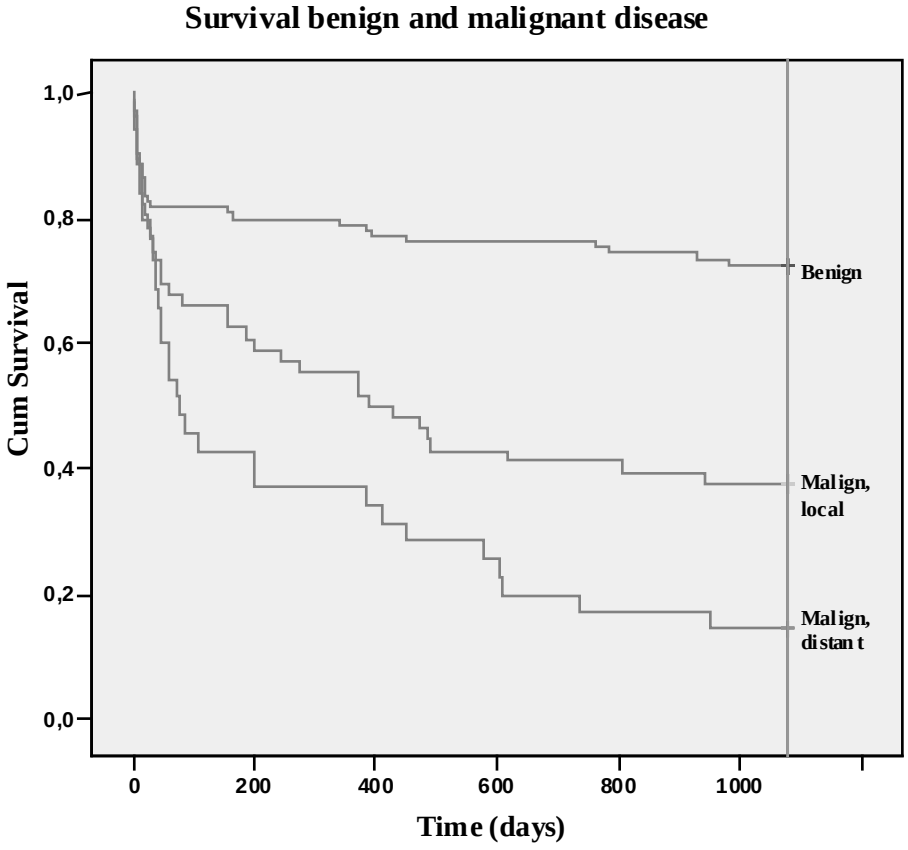

Fig. (2). Survival and malignancy.

Kaplan-Meier curves are shown for patients with benign disease, patients with localized malignant disease and of those with disseminated malignancy.

resection versus no resection (OR = 0.3, p = 0.005, SE = 0.485).

Patients were divided into 10-year age categories for mortality analysis (Fig. **3**). We found a linear correlation between mortality and age from 15 % in the <50 years group to 70 % in the >80 years group (p=0.019, multivariate analysis).

DISCUSSION

Morbidity and mortality after emergency and urgent colorectal surgery in an unselected patient population is substantially higher than that of elective operations. In our department the short-term mortality rate is 6-7 times higher than that of elective procedures even if the procedures performed as urgent and emergency procedures are less exhaustive.

The short-term outcome expressed as 30-day mortality is correlated primarily to the patient related factors ASA score and age. Although the ASA score was originally designed as a rough preoperative physiological status score for anaesthesiologists, in several studies it was found to be an important predictor of postoperative mortality [14, 15]. As the likelihood of co morbidity increases with increasing age it is not surprisingly that the 30-day mortality increased from 8% in the youngest (< 50 years) to 32% in patients >80 years. The 30-day mortality was not different in surgery for benign and malignant disease as shown in Table **2**.

The only procedure-related factor predictive for 30-day mortality was the distinction between procedures that included resection of intestine and those who did not, with a significantly higher survival rate of patients who underwent resections.

The least exhaustive procedures also had a higher complication rate. This may reflect good judgement among the surgeons, choosing quick procedures for high-risk patients. Non-resection is often used as palliative procedures in patients with a lower performance score. However, no firm conclusions based on our data can be drawn.

The 3-year mortality rate was 48 %, with malignant disease being the strongest predictor of mortality. The predictive value of postoperative complications on 3-years mortality may be caused by the fact that 30-day mortality and morbidity may be a suboptimal parameter for short-term postoperative death. As shown in Fig. (**1**), short-term postoperative deaths occur for a longer period than 30 days. In-hospital mortality and morbidity might have been a better parameter for short-term events.

Differences in mortality for procedures performed on the different times of the day were not significant in the multivariate analysis although the mortality rate nearly doubled during night-time compared to daytime. Urgent procedures arriving during evening and night were delayed to daytime surgery if possible. Consequently, night time operations were performed on patients with a very acute need for surgery.

The qualifications of the surgeon was not significant in short-term mortality (p = 0.067) but was significant for 3-year survival rates (p = 0.033). This finding was confirmed in a recent study from Hawkins *et al*. Surgical trainees operating unsupervised by consultants had more surgery specific postoperative complications [16, 17]. Borowski *et al.* did not find a reduced risk of perioperative death in emergency colorectal cancer surgery for high-volume surgeons [18]. For long term survival after colorectal cancer surgery, a high surgeon's annual caseload was found to be an independent beneficial prognostic factor [19].

CONCLUSION

When planning urgent colorectal surgery, patient related factors, the surgical intention (curative or palliative) and the procedure planned should be taken into account for deciding the surgical experience needed. Further studies of emergency colorectal surgery should focus on more detailed risk score analysis including anesthesiological management and infra structure related aspects of emergency surgery in order to improve planning and decision making.

ACKNOWEDGEMENTS

Anita Anfindsen assisted in the database search and registration. Tore Wentzel-Larsen is thanked for statistical advice. "The General Medical Research Foundation", Univer-

Fig. (3). Mortality and age.

The 30 days (striped bars) and 36 months mortality (dotted bars) in percentage (%) are shown for the different age groups.

sity of Bergen, financed the study. Dr Rune Svensen and Dr Anne Karliczek have revised the manuscript.

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Received: November 26, 2008 Revised: December 18, 2008 Accepted: December 26, 2008