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Multimodal Perioperative Rehabilitation for Colonic Surgery in the Elderly

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Abstract
Background Traditional perioperative care for colonic surgery in elderly patients is associated with increased morbidity and mortality compared to that of younger patients. Although multimodal perioperative rehabilitation has evolved as a valid concept to improve postoperative outcome, its use has not yet been established for colonic surgery in the elderly.
Methods Data from 24 German hospitals performing multimodal perioperative rehabilitation as the standard perioperative care for elderly patients who have undergone elective colonic resection was assessed in a prospective multicenter study between April 2005 and April 2007.
Results A total of 742 patients aged ≥70 were examined. Overall compliance with the multimodal care protocol decreased with increasing age. Although laparoscopic colonic surgery was performed in 39.1% of the septuagenarians, the number decreased to 25.1% in the very old patients. The overall complication rate was 22.9% in the septuagenarians (18.1% surgical and 11.6% general complications) and increased in the very old patients to 38.4% (28.0% and 23.6%, respectively) The overall mortality rate was 1.0% and showed no age-specific variations.
Conclusions Although the overall morbidity did increase with age, it was still less when compared to that of historical groups with traditional care. Therefore, multimodal perioperative rehabilitation should be recommended for the elderly.

Introduction

Perioperative multimodal rehabilitation (so-called fast-track rehabilitation, or ERAS—enhanced recovery after

This study is conducted for "Fast-track Colon II" (FTCII) Quality Assurance Group. All participating centers are listed at the end of the article.

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surgery) was first introduced more than a decade ago [1], and Kehlet et al. later noted that the benefits of this evidence-based perioperative care protocol have been demonstrated in almost every surgical speciality [2]. Several studies have demonstrated enhanced postoperative recovery of organ functions, reduced morbidity, and reduced need for postoperative hospitalization and reconvalescence, especially in patients who had undergone colonic surgery [3–6].

With improved life expectancy and high incidence of colonic disease among the elderly the need for safe surgery is increasing. Typically, surgery in the elderly is associated with higher morbidity and mortality rates than are seen in younger age groups. The main arguments against the use of perioperative multimodality rehabilitation in the elderly are that these patients are less compliant, may not tolerate postoperative early feeding and enforced mobilization, and require longer reconvalescence after major surgery.

In 2005, a voluntary, multicenter, open quality assurance program ("Fast-track" Colon II, or FTCII) was initiated in Germany. The following data analysis was intended to evaluate the feasibility and results of perioperative multimodal rehabilitation in elderly patients undergoing elective colonic surgery.

Methods

Between April 2005 and April 2007, a total of 1930 patients were included in the quality assurance program FTCII. In all, 24 hospitals of all sizes performing perioperative multimodal rehabilitation took part in this German prospective open multicenter study. Before recording data, heads of participating surgical departments received detailed written information on the multimodal rehabilitation program; they then declared that the "fast-track" rehabilitation would be the standard perioperative care program for patients undergoing elective colonic surgery in their departments and agreed to include all patients in the database. Thereafter, all patients referred to participating hospitals and scheduled for elective colonic surgery were included in the study.

Patients were excluded if they: underwent emergency surgery or urgent operation within 24 hours of admission to the hospital because of mechanical bowel obstruction; had a perforation or an abscess with septic inflammatory response syndrome; were less than 18 years of age; were pregnant; or refused to participate in the prospective data collection. Indications for surgery and the surgical technique were at the surgeon's discretion. Details of the perioperative clinical perioperative multimodal pathway for elective colonic resection are given in Table 1.

Information concerning perioperative care was entered into a 79-item questionnaire covering preoperative patient preparation, operative technique, anesthesia and analgesia, postoperative care, hospital discharge, and readmission.

General postoperative complications, recorded using a standardized questionnaire, consisted of pulmonary complications (effusion, atelectasis), pneumonia (clinical or radiologic diagnosis requiring physical and/or medical therapy), cardiac complications (ischemia, infarction, arrhythmia, heart failure requiring new or changed therapy), thrombosis (detected by sonography and/or venography), pulmonary embolism diagnosed by computed tomography (CT) or scintigraphy, renal complications (increased

Table 1 Protocol for multimodal perioperative rehabilitation for elective colonic surgery in the German Quality Assurance Program Fast-track Colon II

Time	Procedure
Preoperative	Informed consent; discuss discharge on postoperative days (PODs) 5–7 when feasible; if PONV → prophylaxis (dexamethasone 8 mg)
Intraoperative	Nonopioid analgesia after induction of anesthesia, thoracic combined EDA (LA/opioid, level Th6–8); transverse laparotomy, when feasible laparoscopy-assisted procedure; avoid intraperitoneal drains; extract nasogastric tube at extubation
Day of surgery	Admit to regular nursing floor via PACU continuous EDA (LA/opioid), basal IV nonopioid analgesia, avoid systemic opioids; limit postop. IV fluids to 500 cc, drink 1500 cc, if orthostatic dysregulation occurs add 500–1000 cc of crystalloids IV, 2 protein drinks; magnesium oxide 3 × 300 mg/day until first bowel movement; short walk outside of room, mobilized to chair for 2 h
Postop. day 1	Continuous EDA (LA/opioid), avoid systemic opioids, basal oral nonopioid analgesia; regular hospital food; drink >1500 cc; mobilized out of bed up to 8 h, walk outside of room twice; extract urinary catheter
Postop. day 2	Terminate EDA in the morning; basal IV nonopioid analgesia; regular hospital food; drink >1500 cc; fully mobilize
From postop. day 3	Continue as on day 2, until patient is discharged
Postop. day 8 (if already discharged)	Outpatient clinic; extract skin staples; discuss result of histologic evaluation; plan adjuvant therapy if needed

EDA epidural analgesia, *LA* local anesthetics, *PACU* postanesthesia care unit, *EDC* epidural catheter, *CVL* central venous catheter, *PONV* postoperative nausea and vomiting

retention values requiring a change in therapy), urinary tract infection (positive microbiology and clinical signs), and multiorgan failure. Specific postoperative complications recorded were hemorrhage (requiring either any postoperative blood transfusion or reoperation), bowel obstruction (requiring reoperation), postoperative paralytic ileus (abdominal fullness and repeated vomiting requiring insertion of a nasogastric tube), wound healing impairment (suspicious secretion, redness or pain requiring surgical measures), anastomotic leakage (radiologic findings and/or findings at reoperation), fecal fistula, diffuse peritonitis, intraabdominal or retrorectal abscess, and stoma complications.

The follow-up period was 30 days. Morbidity and readmission rates were collected by physical examination or patient interview after 30 days, depending on the individual hospital's decision. The data were entered by the staff of each participating surgical department during the hospital stay, at discharge, and 30 days after discharge. The head of each participating surgical department was responsible for the data quality. All data were finally referred to the trial coordinator at the University Hospital Charité Campus Mitte, Berlin.

Compliance was defined as fulfilling the single protocol items listed in Table 1. Patients were considered "fit for discharge" when objective discharge criteria were fulfilled, provided that oral intake was sufficient, defecation had occurred, pain could be managed by oral analgesics, and they were considered self-sufficient. Discharge decisions were made by the surgeon. Mortality rates were calculated based on deaths that occurred in hospital, or within 30 days of discharge. To analyze the influence of age on patient behavior, compliance, and outcome of colonic surgery, we compared the age group of the septuagenarians to the group of patients > 79 years old.

All data were entered into a relational database (SPSS 13.0; SPSS, Chicago, IL, USA). Data analysis was performed with SPSS 13.0 and SAS 9.13 (SAS Institute, Cary, NC, USA). Categorical data were compared by applying the chi-squared test, Fisher's exact test (if single cells showed fewer than five events). All continuous data were presented as the median and range; and comparisons between age groups were performed according to the type of distribution. To avoid multiple tests when comparing the two age groups, continuous parameters were analyzed with the Kruskal-Wallis-test. Values of $p < 0.05$ were considered statistically significant.

Results

During the trial period, 2037 patients were recruited; 92 patients refused to participate, and 15 patients were excluded owing to incomplete data entry. This resulted in a participation rate of 94.7%.

The classification of 742 elderly patients into two age groups resulted in the following distribution: 535 patients aged 70 to 79 years (septuagenarians) and 207 patients > 79 years (very old). Detailed information concerning epidemiologic data, American Society of Anesthesiologists (ASA) classification, and concomitant diseases are shown in Table 2. The table shows a clear association between the patient's age and the existence of concomitant diseases. As expected, the incidence of concomitant diseases increased with age (85.3% in the very old), and very old patients were classified as high risk patients much more frequently than septuagenarians.

Table 2 shows the data regarding operative technique, indications for surgery, and the surgical procedure used. Laparoscopic colonic surgery was performed in 39.1% of the septuagenarians, but it decreased to 25.1% in the very old patients. Tumor resection was by far the most common

Table 2 Characteristics of the patients, operative technique, indications for surgery, and surgical procedure

Characteristic	Age 70–79 years	Age >79 years
Patients		
Age (years), median and range	74.7 (70.0–79.9)	83.4 (80.0–95.7)
Sex (female)*	300 (56.1%)	143 (69.2%)
ASA class III/IV*	243 (45.6%)	130 (63.0%)
Concomitant disease		
Cardiac*	321 (60.0%)	162 (78.2%)
Pulmonary*	92 (17.2%)	30 (14.7%)
Diabetes mellitus*	91 (17.0%)	67 (22.3%)
Renal*	32 (5.9%)	24 (11.4%)
Hepatobiliary	5 (0.9%)	5 (2.4%)
Presence of at least one co-morbidity*	375 (70.1%)	177 (85.3%)
Operative technique		
Laparoscopic*	212 (39.1%)	53 (25.1%)
Indications for surgery		
Tumor*	348 (65.0%)	169 (81.6%)
Surgical procedure		
Sigmoidectomy*	240 (44.8%)	58 (28.0%)
Right hemicolectomy*	155 (29.0%)	74 (35.6%)
Left hemicolectomy	59 (11.0%)	26 (12.8%)
Extended hemicolectomy (left or right)*	41 (7.7%)	24 (11.8%)
Ileocecal resection	7 (1.3%)	3 (1.4%)
Segmental resection	15 (2.8%)	10 (4.7%)
Subtotal colectomy	8 (1.5%)	4 (1.9%)
Other (i.e., bypass)	10 (1.8%)	8 (3.8%)
Multivisceral resection	32 (5.9%)	9 (4.3%)

* $P < 0.001$ chi-squared or Fisher's exact test

indication for surgery in the elderly. Right hemicolectomy and extended hemicolectomies were more frequently performed in the very old patients, whereas sigmoidectomy was more common in septuagenarians. The incidence of limited operations (e.g., ileocecal resection, segmental resection, bypass) as well as multivisceral resection did not show any statistically significant difference between the two age groups (each $p > 0.05$).

Postoperative nausea and vomiting (PONV) prophylaxis, epidural analgesia, solid oral food intake on postoperative day 1, and no mechanical preparation of the bowel did not vary between the two age groups. Adherence to other parts of the perioperative multimodal protocol—e.g., restriction of intraoperative intravenous fluids, systemic nonopioid basic analgesia, oral liquid intake on the day of surgery, and postoperative enforced mobilization—decreased in the very old patients (Table 3) (each $p < 0.05$).

Other parameters of perioperative treatment are listed as well in Table 3. Septuagenarians were considered "fit for discharge" within 5 days after surgery and very old patients within 6 days. Despite this fast reconvalescence, patients were usually discharged later, with an interval between being regarded as "fit for discharge" and the actual discharge. This interval increased with increasing age from 3 to 5 days. A total of 95.4% of the septuagenarians were able to be discharged home, but this number decreased statistically significantly with the very old patients to 89.1% ($p < 0.0001$). The readmission rate was 4.6% for the septuagenarians and 2.4% for patients > 79 years of age.

The overall complication rate was 22.9 % for the septuagenarians and increased for the very old patients to 38.4% (Table 4). The incidence of surgical complications increased up to 28.0% in the very old patients. In addition to subcutaneous wound infections, the very old patients suffered more often from prolonged postoperative paralytic ileus (2.8% vs. 8.1%) or recurrent vomiting requiring insertion of a nasogastric tube (7.0% vs. 12.3%). No statistical differences were found between the two age groups in terms of serious surgical complications, such as anastomotic leak, postoperative bleeding, or reoperation for mechanical obstruction (Table 4).

The incidence of general complications increased significantly with increasing age. Whereas catheter-related, hepatic, pulmonary, and thromboembolic complications were not more frequent with increasing age, renal and urinary tract complications and cardiovascular and neuropsychiatric morbidity increased among the very old patients. The mortality rates were 1.1% vs. 0.9 % for the septuagenarians versus the very old patients, with no statistical difference between the two age groups (Table 4).

Table 5 shows the comparison between laparoscopic and open procedures regarding general and surgical

Table 3 Compliance with specific measures of the multimodal perioperative rehabilitation program, discharge criteria, readmission, and indication for readmission

Parameter	Age 70–79 years	Age >79 years
Perioperative treatment (no. of patients)		
No mechanical bowel preparation	430 (80.4%)	171 (82.5%)
PONV prophylaxis	500 (93.4%)	197 (95.3%)
Epidural analgesia	458 (85.6%)	179 (86.3%)
Infusion of <3000 cc during surgery[†]	462 (86.5%)	168 (81.0%)
Systemic nonopioid basic analgesia[a,***]	494 (92.4%)	183 (88.6%)
Oral liquids on day of surgery***	401 (74.9%)	143 (69.2%)
Solid food on POD 1	319 (59.6%)	105 (50.7%)
IV fluids > POD 1	136 (25.5%)	78 (37.9%)
Mobilized out of bed on day of surgery***	377 (70.5%)	114 (55.0%)
Mobilized out of bed >2 h on POD 1***	371 (69.3%)	110 (53.1%)
Discharge to home**	510 (95.4%)	184 (89.1%)
Readmission***	25 (4.6%)	5 (2.4%)
Indication for readmission		
Surgical complication	14 (2.6%)	2 (0.9%)
General complication	10 (1.8%)	3 (1.4%)
"Social" indication	1 (0.2%)	0
Discharge factors		
Discharge criteria fulfilled on POD*	6.37/5 (2–83)[b]	6.94/6 (3–32)[b]
Discharged on POD*	10.59/8 (2–83)[b]	12.26/11 (1–53)[b]
Interval from "fit for discharge" until discharge	3	5

POD: postoperative day

[a] Paracetamol or metamizol and/or nonsteroidal antiinflammatory drugs (NSAIDS)/COX2 inhibitors

[b] Mean/median (range)

* $P < 0.001$ Kruskal-Wallis test; ** $P < 0.001$ chi-squared or Fisher's exact test; *** $P < 0.05$ chi-squared or Fisher's exact test; [†] $P = 0.05$ chi-squared or Fisher's exact test

Table 4 Overall, surgical, and general complications

Complications	Age 70–79 years	Age >79 years
Overall no.*	123 (22.9%)	79 (38.4%)
Surgical complications*	97 (18.1%)	58 (28.0%)
Subcutaneous wound infection**	46 (8.6%)	22 (10.4%)
Anastomotic leakage	19 (3.5%)	3 (1.4%)
Bleeding (reoperation)	1 (0.2%)	3 (1.4%)
Bowel obstruction (reoperation)	3 (0.6%)	2 (0.9%)
Prolonged postop. paralytic ileus[a,*]	15 (2.8%)	17 (8.1%)
Postop. insertion of nasogastric tube[b]	37 (7.0%)	25 (12.3%)
General complications		
Incidents	62 (11.6%)	48 (23.6%)
Cardiac*	29 (5.4%)	24 (11.4%)
Pulmonary	28 (5.2%)	10 (4.7%)
Renal**	1 (0.2%)	8 (3.8%)
Neurologic/psychiatric*	6 (1.1%)	10 (4.7%)
Urinary tract**	9 (1.7%)	8 (3.8%)
Catheter-related	2 (0.4%)	1 (0.5%)
Hepatic	0	0
Deep vein thrombosis	2 (0.4%)	1 (0.5%)
Mortality	6 (1.1%)	2 (0.9%)

[a] Recurrent vomiting, abdominal distension, cramping, no bowel movement

[b] Due to recurrent vomiting despite regular bowel movements

* $P < 0.001$ chi-squared or Fisher's exact test; ** $P < 0.05$ chi-squared or Fisher's exact test

Table 5 Surgical and general complications, discharge criteria, and discharge compared between laparoscopic and open procedure surgical complications

Parameter, by age	Open surgery	Laparoscopy
Surgical complications (no.)		
70–79 years	53 (16.4%)	28 (13.2%)
>79 years	39 (25.3%)	10 (18.9%)
General complications (no.)		
70–79 years	42 (13%)	21 (9.9%)
>79 years	34 (22.1%)	14 (26.4%)
POD when discharge criteria were fulfilled: mean/median (range)		
70–79 years**	7.21/5.0 (2–83)	5.54/5.0 (2–50)
>79 years	7.59/6.0 (3–32)	6.29/5.0 (3–32)
POD of discharge: mean/median (range)		
70–79 years***	11.91/9.0 (2–83)	9.28/8.0 (3–72)
>79 years***	13.57/11.0 (1–53)	10.96/10.0 (5–22)

** $P < 0.001$ Kruskal-Wallis test; *** $P < 0.05$ Kruskal-Wallis test

complications; there were no statistical differences. The discharge criteria were fulfilled significantly earlier with the laparoscopic procedure in the septuagenarians. The actual hospital stay was significantly shorter with the laparoscopic procedure in both age groups.

Discussion

Colorectal cancer is predominantly a disease of the elderly and a major cause of morbidity and mortality in the elderly population [7]. As the incidence of colorectal disease rises with improved life expectancy [8], there will be an increasing need for colorectal surgery in the future. However, with "traditional" perioperative care, age is a significant, independent risk factor for in-hospital mortality, prolonged stay in the intensive care unit (ICU), reoperation, and prolonged hospitalization [9].

Although studies on perioperative multimodal rehabilitation have demonstrated improved postoperative outcomes [10–12] and the ERAS concept has become more common, some surgeons hesitate to use multimodal care protocols with the elderly. This reluctance is mainly due to the fact that perioperative treatment of patients undergoing elective colonic surgery is still based on traditions rather than on validated scientific evidence [13, 14]. It is also due to the fact that elderly patients show a higher frequency of co-morbid conditions (e.g., cardiovascular and pulmonary disease, diabetes mellitus, cerebrovascular disorders) than younger patients. Against this background, surgeons tend to avoid straining elderly patients with accelerated perioperative management, including early discharge from hospital. However, elderly and high risk patients may especially benefit from a multimodal perioperative approach to control perioperative pathophysiology, avoid organ dysfunction, sustain homeostasis, and enhance patient autonomy [3, 4].

Analysis of the presented patient pool confirmed that increasing patient age is associated with an increasing incidence of co-morbid conditions and an increasing proportion of patients being categorized into the high risk ASA class III/IV. This tallies with figures in the literature

[7–9, 15–18]. The high incidence of ASA III/IV among FTCII patients also demonstrates that no specific patient selection was undertaken for application of the multimodal perioperative protocol.

Malignant disease was the most common indication for surgery in our patient population. The percentage of laparoscopically performed operations decreased to only 25% in the very old patients. This shows that between 2005 and 2007 (just at the beginning of the later widespread acceptance of the results of the COLOR, CLASSIC, and COST trials [19–21] German surgeons were still reluctant to use lapasocopic techniques for malignancy. This is also in contrast to the literature, which reports positive experiences with laparoscopic procedures in the elderly [8, 22, 23]. However, in a patient- and observer-blinded trial comparing open versus laparoscopic fast-track colonic resection, no differences were noted in several physiologic recovery outcomes and the hospital stay [24]. Furthermore, it was shown in patients 70 years of age undergoing elective open colon resection that early feeding results in a short hospital stay and low postoperative morbidity, comparable to that reported for laparoscopy-assisted colectomy [25]. In our series as well, there were no differences between open and laparoscopically treated patients regarding general and surgical complications.

For the two age groups, the perioperative treatment parameters do not differ with regard to PONV prophylaxis, epidural analgesia, or solid diet on the day after surgery; however, surgeons and anesthesiologists were significantly more reluctant to apply other principles of the perioperative multimodal protocol, especially to the very old patients. Mechanical bowel preparation, restriction of intraoperative intravenous fluids, systemic nonopioid basic analgesia, immediate mobilization, and liquid oral diet on the day of surgery were applied to most of the very old patients, but with statistically significantly less compliance than in the younger age group. The restraint to adopt these cornerstones of multimodal perioperative rehabilitation programs with increasing patient age may be explained by the increase in co-morbidity with age and the fear of overstraining elderly patients, even in hospitals performing perioperative multimodal rehabilitation as a routine procedure.

The higher incidence of surgical complications in the very old patients was mainly due to minor complications (e.g., prolonged postoperative paralytic ileus with an increased need for reinsertion of a nasogastric tube postoperatively). The rate of major surgical complications (e.g., anastomotic leak, postoperative bleeding, or bowel obstruction requiring reoperation) did not essentially differ among the two age groups. These data are similar to those in the literature [7, 15]. Thus, if an older patient is believed to be fit for surgery, a standard surgical procedure can be performed without an increase of major surgical and anastomotic complications.

The significant increase in general complications among very old patients is mainly due to an increase in cardiac, renal, neurologic, and urinary tract complications. Nevertheless, compared to a historical cohort, the very old FTCII patients showed fewer general complications. The results of a prior German quality assurance program by the Working Group Colon/Rectum Cancer (WGCRC)—based on the same study design as FTCII but using traditional perioperative treatment—for conventional elective colon cancer surgery in elderly patients $\geq$ 80 years of age yielded a general morbidity of 31.9% [15]. In comparison with these results, the general morbidity among our patients $>$ 79 years was 23.6%, with no major differences in the ASA classification (ASA III/IV: WGCRC 68.3% vs. FTCII 63.0%).

The mortality rate showed no age-specific variations even for the very old patients (0.9%). This is a significant reduction compared to the mortality rate after colorectal surgery in the very old reported in the literature (5.1–19.4%) [7, 8, 26].

In our study, the postoperative hospital stay was significantly longer than was stipulated in the multimodal rehabilitation protocol [3, 4]. The predefined discharge criteria were met 6 days after surgery by the very old patients (median hospital stay 11 days) and on postoperative day 5 by the septuagenarians (median hospital stay 8 days). This implies that non-medical-related reasons account for prolonged postoperative hospital stays (e.g., the very old patients do not have all the necessary social or other requirements necessary to go home). It could also be due to the financial disincentives inherent in the German "DRG system," which discourage discharge before postoperative day 8 because of a then decreased reimbursement of costs. Compared to an average actual postoperative stay after colonic resection in Germany of 13.2 days [2], the reported length of stay is considerably shorter. It is interesting to note, however, that the use of the laparoscopic procedure abbreviated the hospital stay in our series.

The rate of readmission (total 3.5%) is low compared to that in the literature (approximately 10%) [11, 19]. This is explained by the rather long time span between "fit for discharge" and "actually discharged" for the FTCII patients; very old patients were those with the longest interval (5 days), but had the lowest readmission rate (2.4%).

Conclusions

Our data show that the multimodal perioperative rehabilitation protocol can easily and safely be adopted for elderly patients in diverse clinical settings. Multimodal care was applied to most of the very old patients but with statistically

significant less compliance than the septuagenarians. The overall complication rate in the very old increased but was still less compared to historical groups treated with traditional care. The readmission rate within 30 days of discharge and the mortality rate were low. Based on the results of this study, multimodal perioperative rehabilitation should be recommended for elderly patients.

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Appendix

The following surgeons and hospitals participated in the "Fast-track"-Colon II registry by providing at least one patient.

P. Wendling, Kliniken des Main-Taunus-Kreises GmbH, Krankenhaus Bad Soden; R. Engemann, Klinikum Aschaffenburg; M. Schmid, Westpfalz-Klinikum GmbH Standort III Kirchheimbolanden; W. Probst, Ammerland Klinik GmbH, Westerstede; K. Kipfmüller, Sankt-Marien Hospital, Mühlheim an der Ruhr; J.M. Müller Charité Campus Mitte, Berlin; B. Rumstadt, Diakoniekrankenhaus, Mannheim; M.K. Walz, Kliniken Essen-Mitte, Essen; K. Nagel, Marienhospital, Aachen; J. Gönninger, Klinikum Minden; K. Schönleben, Klinikum der Stadt Ludwigshafen; B. Vetter, St. Elisabeth-Krankenhaus, Lörrach; H.P. Meyer, Hunsrück Klinik Kreuznacher Diakonie, Simmern; B. Rehnisch, Klinikum des Landkreises Löbau-Zittau gGmbH, Zittau; H.W. Krawzak, Klinikum Niederberg, Velbert ; C.T. Germer, Klinikum Nürnberg; A. Hirner, Universitätsklinikum Bonn; M. Varney, Städtisches Klinikum Gütersloh; D. Ockert, Krankenhaus der Barmherzigen Brüder, Trier; V. Paolucci, Ketteler Krankenhaus, Offenbach; M. Kahle, St. Elisabeth-Krankenhaus, Bad Kissingen; A. Trupka, Klinikum Starnberg; K. Zarras, St. Vinzenz-Hospital Düsseldorf; W. Timmermann, Allgemeines Krankenhaus Hagen.

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