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ORIGINAL ARTICLE

The usefulness of Enhanced Recovery After Surgery concepts for colorectal resections: an economic analysis under DRG conditions

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Abstract

Purpose ERAS® (Enhanced Recovery After Surgery) describes a multimodal, interdisciplinary, and interprofessional treatment concept that optimizes the postoperative convalescence of the patient through the use of evidence-based measures. Goal of the work.

The aim of this article is to examine the economic feasibility of the ERAS® concept in the German DRG (diagnosis-related groups) system.

Material and methods Since August 2019, patients have been treated in our clinic according to the later certified ERAS® concept. The last 50 patients before ERAS® implementation are compared below with 50 patients after ERAS® implementation, who were identified using a matched pair analysis. In addition to the comparison of costs and revenues, the clinical outcome of the patients is also presented.

Results The cases of the patients in the pre-ERAS® cohort caused median costs of € 7432.83. BWR (valuation ratio) of 3.38 were billable. The resulting DRG revenue for the patients in this group amounted to € 11,325.78. The proceeds generated in the end amounted to € 4575.14. The cases of patients in the ERAS® cohort resulted in costs of € 5582.96. BWR of 2.84 could be billed. The DRG proceeds for the patients in this group therefore amounted to € 10,014.18. The profit generated was thus € 4993.84.

Conclusion The cost reduction generated by ERAS® was more pronounced than the "loss" due to the decrease in BWR. ERAS® is therefore also possible in the German DRG system at absolutely cost-covering levels.

Keywords ERAS · Fast track · DRG · Outcome · Colorectal cancer

Introduction

Dane Henrik Kehlet is the founder of modern fast-track concepts. In the 1990s, he began to design perioperative treatment processes based on evidence [1, 2]. Olle Ljungqvist and Ken Fearon further developed this concept and named it the Enhanced Recovery After Surgery (ERAS) process [3, 4]. Since the beginning of the 2000s, numerous studies have been published on the effectiveness of this concept [5–7]. By standardizing and optimizing the perioperative processes based on available current evidence, the complication rate is reduced, and the length of stay is shortened [4–7]. Despite convincing results and initial indications that a reduction in complications can also improve patients' oncological outcomes [8], the concept is spreading very slowly in Germany. One of the reasons relates to the refinancing of the DRG system. This study aimed to compare the costs and refinancing of the DRG system between a preERAS® and an ERAS® cohort. Patient and clinical outcomes were also considered.

ERAS® concept

ERAS® is an interdisciplinary and interprofessional concept that improves patient recovery after surgery. In the current

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guidelines published by the ERAS® Society 2018 for colorectal resections, 24 recommendations were made [9]. The recommendations covered different aspects of the patient's surgical journey, including pre-admission (patient education, nutritional screening, and anemia treatment), and the pre-, intra-, and postoperative phases (intestinal lavage, sedating premedication, anesthesia form, analgesic questions, intestinal stimulation, and thrombosis prophylaxis). ERAS® describes a concept with interlocking sub-steps. In February 2020, our clinic became the first clinic in Germany to be certified by the ERAS® Society to use the ERAS® concept for colorectal resections.

Flat rates and calculations for hospital funding

In Germany, billing between hospitals and health insurance companies is based on flat rates. The flat rate case grouping in the DRG is computer-assisted and determined by the diagnosis, the severity of the disease, and the services provided (operations and procedures) [10]. The so-called valuation ratio (BWR) ultimately results from this grouping. The BWR is multiplied by the annually adjusted base rate for the state to determine the funding allocation. For the analysis in this work, the state-based case value of Mecklenburg-Western Pomerania valid in the year of treatment was used.

Lower, average, and upper limits of the length of stay are defined for each flat rate per case. The hospital receives a fixed amount based on these limits. If the patient is discharged before the lower limit of the length of stay, a deduction is made to the flat rate per case. If the patient is discharged after the upper limit of the length of stay, the hospital receives additional payment for each additional day from the health insurers. From a statistical point of view, the mean length of stay is the day on which the hospital's costs are exactly covered by the flat rate per case payment. Therefore, it is ideal to discharge the patient between the lower and median limit of the length of stay. The lower length of stay was originally introduced to avoid "bloody" dismissals. Critics, on the other hand, believe that this is partly responsible for the lengthy hospital stays in Germany. In a European comparison, Germany ranked fourth in the longest hospital length of stay, with an average of 9 days [11]. For colon and rectum resections, the lower limit of the length of stay in Germany is currently 3 days.

Calculation hospitals

There are so-called calculation hospitals that orient the case flat rates to real needs and to further develop the DRG system. At the beginning of 2017, there were 242 clinics with an evaluable case volume of approximately 3.7 million cases [12]. These hospitals transmit an extensive data set (the InEK cost matrix), to the Institute for the Hospital Remuneration System (InEK). This is initially divided into personnel, materials, and infrastructure costs. The personnel costs are broken down into medical, nursing, and functional services. Material costs include the costs of drugs, transplants/implants, and other medical needs. Infrastructure costs are divided into medical and non-medical costs. The individual costs are split into the normal ward, intensive care ward, operating theater, radiology, laboratories, etc. This results in precise cost distribution. Our clinic is a calculation hospital, and the costs are therefore available at the case level.

Material and methods

Since August 2019, patients have been treated in our clinic according to the certified ERAS® concept. In this study, the last 50 patients before ERAS® implementation were compared with 50 patients after ERAS® implementation, who were identified using a matched pair analysis (criteria: age, sex, diagnosis, and colon/rectum resection). The *t*-test was used for group comparison. A p value of 0.05 was used as the cut-off for significance.

The costs per case were evaluated in the present study. To map the nursing costs more precisely, the nursing services in minutes per patient (documented by the nursing staff) were multiplied by the gross personnel costs per full-time position and included in the cost accounting.

The difference between the generated DRG revenue and costs was calculated as the generated revenue (colloquially, profit). The median and the minimum and maximum values are given.

In addition to the comparison of costs and revenues, the clinical outcomes of the patients were investigated. Comparisons were made for the following parameters:

- Length of stay
- Resumption rate (defined as any readmission to the hospital)
- Re-operations (defined as patients who required at least one revision procedure)
- Stay at intermediate care or intensive care unit
- Mortality
- Complications (surgical complications, such as wound infections classified as defined by the CDC classification, secondary bleeding, and anastomotic leakage, and non-surgical complications, such as urinary tract infections and pneumonia)

Statistics

In the case of a normal distribution, which was checked with Q-Q plots, the distribution of metric variables is described

with mean, standard deviation, and extreme values. The *t* test was used for group comparison. If there was no normal distribution, the distributions were characterized with median and extrema and the group comparisons were carried out using the Mann–Whitney *U* test. When comparing groups with regard to relative frequencies, the chi-square test or, in the case of low cell population, Fisher's exact test was used. All *p* values are interpreted purely descriptively.

Results

Table 1 provides an overview of the patient characteristics of both groups. The groups were comparable in all the characteristics listed (*p* value for matching criteria greater than 0.05 in each case).

The patients in the preERAS® cohort were in the clinic for a median of 7 days and thus 2 days longer than those in the ERAS® cohort. In absolute numbers, this means that the 50 patients in the preERAS® cohort were treated in the hospital for 448 days altogether, whereas the patients in the ERAS® cohort were only treated for 348 days. The shortening of the primary stay did not increase the readmission rate (preERAS® 6% vs. ERAS® 8%). The number of complications was halved in the ERAS® cohort (pre-ERAS® 20%, ERAS® 10%). The re-operation rate decreased from 16% in the pre-ERAS® cohort to 10% in the ERAS® group. The number of days that patients had to be looked after in an intermediate or intensive care unit reduced from 87 days in the pre-ERAS® patients to 46 days in the ERAS® cohort. This corresponded to a reduction from an average of 1.7 days/patient pre-ERAS® to 0.9 day/patient after ERAS® implementation. In the pre-ERAS® cohort, two patients died. In the ERAS® cohort, there were no deaths. Table 2 summarizes the clinical outcome parameters of the two groups.

The cost of caring for patients in the pre-ERAS® cohort was € 7030.20 (median; min. € 4211.79, max. € 18,554.59). A BWR of 3.38 (min. 2.24, max. 15.64) was billed. The resulting DRG revenue for the patients in this group amounted to € 11,325.78 (min. € 7499.18, max. €

Table 1 Patient characteristics

	preERAS®	ERAS®
Female:male	21:29	22:28
Age (mean)	68.5 (min. 48, max. 87)	69 (min. 38, max. 85)
Colon resection (*n*)	30	29
Rectal resection (*n*)	20	21
Benign disease (*n*)	7 Diverticulitis 4 Adenoma 3	9 Diverticulitis 5 Adenoma 4
Malign disease (*n*)	43 Rectal cancer 19 (12 × neoadjuvant chemoradiotherapy) Colon cancer 24 UICC I: 14 UICC II: 15 UICC III: 13 UICC IV: 1	41 Rectal cancer 21 (13 × neoadjuvant chemoradiotherapy) Colon cancer 20 UICC I: 9 UICC II: 12 UICC III: 19 UICC IV: 1
Open access (*n*)	5	2
Minimally invasive access (laparoscopic; *n*)	39	42
Converted operation from minimally invasive to open (*n*)	6 Due to: 1 × conglomerate tumor 2 × tumor size 3 × narrow pelvis	6 Due to: 1 × adhesions 1 × firm adhesions to the retroperitoneum 1 × adipositas 1 × narrow pelvis 1 × tumor size 1 × conglomerate tumor
Duration of surgery (mean)	153 min (min. 95, max. 355)	162 min (min. 75, max. 375)
ASA 1 (*n*)	3	1
ASA 2 (*n*)	17	25
ASA 3 (*n*)	29	24
ASA 4 (*n*)	1	0

52,383.81). The revenue ultimately generated was € 4339.50 (min. € − 8111.09, max. € 41,360.86).

The ERAS® cases were included in 2019 and 2020 (2019, 24 cases; 2020, 26 cases). The coronavirus disease (COVID-19) pandemic has led to further changes in the DRG system. Hence, the cases were separated by year for further consideration.

The cost of caring for patients in the 2019 ERAS® cohort was € 5599.61 (min. € 3686.21, max. € 16,369.37). A BWR of 2.84 (min. 1.47, max. 8.4) was billed. The DRG revenue for the patients in this group was € 10,014.18 (min. € 5171.23, max. € 29,654.27). The profit generated amounted to € 4766.98 (min. € − 2239.40, max. € 17,083.78). In contrast, the cost of caring for patients in the 2020 ERAS® group was € 7481.85 (min. € 4668.95, max. € 25,793.90). A BWR of 2.87 (min. 1.91, max. 8.35) was billed. Accordingly, a DRG revenue of € 10,127.14 was generated (min. € 7013.50, max. € 29,777.81). The profit from the 2020 ERAS® cohort amounted to € 2724.01 (min. € − 11,011.65, max. € 9,000.44). Table 3 provides a summary of the cost and revenue of the three groups.

A more detailed consideration of the cost drivers based on the InEK cost matrix highlighted the cause of the cost increase in 2020. This is shown in Table 4. Using personnel costs for the medical staff as an example, the preERAS® cost (max. € 15,436.82) was reduced to € 1974.12 (min. € 1200.89; max. € 6764.58) in the 2019 ERAS® group, and € 2902.40 (median; min. 1589.94 €; max. 10,390.98 €) in the 2020 ERAS® group. This trend is also evident in the nursing staff cost. The preERAS® cost amounted to € 515.76 (min. € 50.96; max. € 2,882.88). After the implementation of ERAS®, the costs fell to € 249.38 in 2019 (min. € 55.29; max. € 826.50). In 2020, these costs rose again to € 337.90 (min. € 89.28; max. € 2236.34).

In relation to the causative unit, a detailed breakdown of the figures showed that the increase in personnel costs mainly affected the costs in the normal ward [preERAS®: € 2151.10 (min. € 1199.88; max. € 9051.06); 2019 ERAS®: € 1148.41 (min. € 882.28; max. € 3944.28); 2020 ERAS®: 2020 € 2272.33 (min. € 1057.25; max. € 9281.66)]. The top three cost drivers are listed in Table 5.

Discussion

The ERAS® concept has proven its clinical effectiveness in numerous studies. However, the topic of financial mapping within the German DRG system has not yet been analyzed. The present study aimed to address this gap.

Our study results highlighted two important considerations:

Table 2 Clinical outcome of the different groups

	preERAS®	ERAS®	*p*
Length of primary stay (median and total)	7d (min. 4d, max. 39d); total 448 days	5d (min. 3d, max. 29d), total 348 days	< 0.001
Readmissions	3 (6%)	4 (8%)	-
Length of stay including readmissions (median and total)	7d (min. 4d, max. 58d); total 560 days	5d (min. 3d, max. 29d), total 380 days	< 0.001
Nights in the intensive care or intermediate care	92 (Ø 1.8d/patient; SD 5.91)	46 (Ø 0.9d/patient; SD 3.3)	0.503
Complication rate	10 (20%)	5 (10%)	-
Anastomotic leakage	4 (8%), all re-operated	2 (4%), all re-operated	-
Patients with operative revisions	8 (16%) Anastomotic leakage *n* = 4 Wound infection *n* = 2 Bleeding wound *n* = 1 Fascial dehiscence *n* = 1	5 (10%) Anastomotic leakage *n* = 2 Mechanical ileus *n* = 2 Wound infection *n* = 1	-
Mortality	2 (4%)	0 (0%)	-

Table 3 Economic outcome of the different groups. The DRG revenue was calculated using the state base rate for the respective year

	preERAS®	ERAS® 2019	*p* value	ERAS® 2020	*p* value
Costs	7030.20 € (min. 4211.79 €, max. 18,554.59 €)	5599.61 € (min. 3686.21 €, max. 16,369.37 €)	0.302	7481.85 € (min. 4668.95 €, max. 25,793.90 €)	0.667
Valuation ratio (BWR)	3.38 (min. 2.24, max. 15.64)	2.84 (min. 1.47, max. 8.4)	1	2.87 (min. 1.91, max. 8.35)	1
DRG revenue	11,325.78 € (min. 7499.18 €, max. 52,383.81 €)	10,014.18 € (min. 5171.23 €, max. 29,654.27 €)	0.09	10,127.14 € (min. 7013.50 €, max. 29,777.81 €)	0.001
Profit	4339.50 € (min. − 8111.09 €, max. 41,360.86 €)	4766.98 € (min. − 2239.40 €, max. 17,083.78 €)	0.73	2724.01 € (min. − 11,011.65 €, max. 9000.44 €)	0.25

Table 4 InEK cost matrix using the example of personnel costs

	preERAS®	ERAS® 2019	ERAS® 2020
1. Personnel costs Medical staff	2666.35 € (min. 1481.59 €; max. 15,436.82 €)	1974.12 € (min. 1200.89 €; max. 6764.58 €)	2902.40 € (min. 1589.94 €; max. 10,390.98 €)
2. Personnel costs Nursing staff	515.76 € (min. 50.96 €; max. 2882.88 €)	249.38 € (min. 55.29 €; max. 826.50 €)	337.90 € (min. 89.28 €; max. 2236.34 €)
3. Personnel costs Med. tech./ functional service	1152.54 € (min. 611.17 €; max. 4463.48 €)	935.03 € (min. 620.87 €; max. 2086.92 €)	1003.81 € (min. 552.61 €; max. 3283.31 €)

1. The ERAS® concept shortened the hospital stay of patients with colorectal resections

In our study cohort, the introduction of the ERAS® concept and the associated treatment process alignment with evidence-based measures led to a significant shorter hospital stay, with the same rate of readmission. Overall, the median length of stay was reduced from 7 to 5 days. While this does not seem substantial in absolute numbers, the length of stay including readmission was reduced by 32% from 560 days pre-ERAS® to 380 days after the ERAS® concept was implemented. The need for intensive medical care was reduced by 48%. These results are consistent with other published studies [4, 7, 12, 13].

2. The ERAS® concept can be economically mapped to the German DRG system

The reduction in the length of hospital stay, and the rate of complications through the implementation of a functioning ERAS® concept consequently led to a cost reduction. This has been demonstrated for different entities in different countries [14–19]. Roulin et al. demonstrated an average cost reduction of € 1651 for colorectal resections in Switzerland (the costs for implementation were already deducted). In our cohort, a median cost reduction of € 1430.59 was achieved when comparing the preERAS® and 2019 ERAS® groups. This corresponded to 20% savings. The observed increase in costs in 2020 may be due to plummeted case numbers in German hospitals during the COVID-19 pandemic. Postponement of elective admissions and interventions ensured sufficient hospital capacity to care for patients with COVID-19. This contributed to a relevant reduction in case numbers. For example, personnel and overhead costs were distributed in significantly fewer cases in 2020. In our 2020 cohort, this led to an increase in the medical personnel cost per case to 1.5 times that of 2019. The nursing personnel cost was calculated using the documented nursing minutes; thus, the same effect was not observed. The increase may be explained as the lower number of cases left more time for the individual patient; therefore, the documented care minutes increased.

As mentioned, the length of hospital stay in Germany is one of the longest in Europe, with an average of 9 days [11]. From an economic viewpoint, the correspondingly high lower limit length of stay does not encourage patients to be discharged quickly. This "negative" effect was observed in our cohort. Deductions resulted due to cases falling below the lower limit of the length of stay. Moreover, as a result of the additional reduction in the complication rate achieved by the ERAS® concept, the median BWR generated per case fell by 16%.

However, the cost reduction generated by the 2019 ERAS® group was slightly more pronounced than the "loss" due to the decrease in BWR. This suggests that the ERAS® concept is viable in the German DRG system based on absolute cost coverage.

Conclusion

The effectiveness of the ERAS® concept in colorectal resections is undisputed and economically sensible, especially in financing the health system. In this study, the ERAS® concept halved the complication rate, shortened the length of stay, and reduced demand for the intensive care or

Table 5 InEK cost matrix broken down by unit

	preERAS®	ERAS® 2019	ERAS® 2020
01. Normal ward	2151.10 € (min. 1199.88 €; max. 9051.06 €)	1148.41 € (min. 882.28 €; max. 3944.28 €)	2272.33 € (min. 1057.25 €; max. 9281.66 €)
04. Operating room	2579.31 € (min. 726.39 €; 6035.61 €)	2709.46 € (min. 1553.70 €; max. 5657.51 €)	3347.12 € (min. 2134.04 €; max. 8834.56 €)
05. Anesthesia	1004.08 € (min. 598.92 €; max. 2623.28 €)	979.50 € (min. 555.18 €; max. 1666.72 €)	1048.29 € (min. 740.79 €; max. 3628.27 €)

intermediate care unit. Even during pandemic times, with increased personnel costs per case, overall costs were stable by the ERAS® concept.

Authors' contributions Study conception and design: Koch F, Green M, Dietrich M, Moikow L, Schmidt M, Ristig M, Meier-Hellmann A, Ritz JP. Acquisition of data: Koch F, Schmidt M, Meier-Hellmann A, Ritz JP. Analysis and interpretation of data: Koch F, Schmidt M, Meier-Hellmann A, Ritz JP. Drafting of manuscript: Koch F, Ritz JP. Critical revision of manuscript: Koch F, Green M, Dietrich M, Moikow L, Schmidt M, Ristig M, Meier-Hellmann A, Ritz JP.

Data availability Helios Health and Helios Hospitals have strict rules regarding data sharing because health claims data have ethical restrictions imposed due to privacy concerns. Access to anonymized data that support the findings of this study are available upon request.

Code availability Not applicable.

Declarations

Ethics approval This study was approved by the Ethics Committee of the Medical Faculty, Rostock University.

Consent to participate Due to the retrospective nature of the study, informed consent was not obtained.

Consent for publication Due to the retrospective nature of the study, informed consent was not obtained.

Conflict of interest The authors declare no competing interests.

References

1. Kehlet H, Wilmore DW (1997) Multimodal approach to control postoperative pathophysiology and rehabilitation. Br J Anaesth 78:606–617
2. Bardram L, Funch-Jensen P, Jensen P, Crawford ME, Kehlet H (1995) Recovery after laparoscopic colonic surgery with epidural analgesia, and early oral nutrition and mobilisation. Lancet 345(8952):763–764
3. Ljungqvist O (2014) ERAS—enhanced recovery after surgery: moving evidence-based perioperative care to practice. JPEN J Parenter Enteral Nutr 38:559–566
4. Ljungqvist O, Scott M, Fearon KC (2017) Enhanced Recovery After Surgery – a review. JAMA Surg 152(3):292–298
5. van Dijk DPJ, van Woerden V, Cakir H, den Dulk M, Olde Damink SWM, Dejong CHC (2017) ERAS: improving outcome in the cachectic HPB patient. J Surg Oncol 116(5):617–622
6. Schneider S, Armbrust R, Spies C, du Bois A, Sehouli J (2020) Prehabilitation programs and ERAS protocols in gynecological oncology: a comprehensive review. Arch Gynecol Obstet 301(2):315–326
7. Ni X, Jia D, Chen Y, Wang L, Suo J (2019) Is the Enhanced Recovery After Surgery (ERAS) program effective and safe in laparoscopic colorectal cancer surgery? A meta-analysis of randomized controlled trials. J Gastrointest Surg 23(7):1502–1512
8. Pisarska M, Torbicz G, Gajewska N, Rubinkiewicz M, Wierdak M, Major P, Budzyński A, Ljungqvist O, Pędziwiatr M (2019) Compliance with the ERAS protocol and 3-year survival after laparoscopic surgery for non-metastatic colorectal cancer. World J Surg 43(10):2552–2560
9. Gustafsson UO, Scott MJ, Hubner M, Nygren J, Demartines N, Francis N, Rockall TA, Young-Fadok TM, Hill AG, Soop M, de Boer HD, Urman RD, Chang GJ, Fichera A, Kessler H, Grass F, Whang EE, Fawcett WJ, Carli F, Lobo DN, Rollins KE, Balfour A, Baldini G, Riedel B, Ljungqvist O (2019) Guidelines for perioperative care in elective colorectal surgery: Enhanced Recovery After Surgery (ERAS) society recommendations: 2018. World J Surg 43:659–695
10. https://www.bundesgesundheitsministerium.de/krankenhausfinanzierung.html Aufruf: 08.03.2021
11. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Hospital_discharges_and_length_of_stay_statistics#Hospital_discharges Aufruf: 08.03.2021
12. https://reimbursement.institute/glossar/kalkulationskrankenhaeuser/ Aufruf: 08.03.2021
13. Ban KA, Berian JR, Ko CY (2019) Does implementation of Enhanced Recovery after Surgery (ERAS) protocols in colorectal surgery improve patient outcomes? Clin Colon Rectal Surg 32(2):109–113
14. Bona S, Molteni M, Rosati R, Elmore U, Bagnoli P, Monzani R, Caravaca M, Montorsi M (2014) Introducing an enhanced recovery after surgery program in colorectal surgery: a single center experience. World J Gastroenterol 20(46):17578–87
15. Pache B, Joliat GR, Hübner M, Grass F, Demartines N, Mathevet P, Achtari C (2019) Cost-analysis of Enhanced Recovery After Surgery (ERAS) program in gynecologic surgery. Gynecol Oncol 154(2):388–393
16. Stone AB, Grant MC, Roda CP, Hobson D, Pawlik T, Wu CL, Wick EC (2016) Implementation costs of an Enhanced Recovery After Surgery program in the United States: a financial model and sensitivity analysis based on experiences at a quaternary academic medical center. J Am Coll Surg 222(3):219–225
17. Noba L, Rodgers S, Chandler C, Balfour A, Hariharan D, Yip VS (2020) Enhanced Recovery After Surgery (ERAS) reduces hospital costs and improve clinical outcomes in liver surgery: a systematic review and meta-analysis. J Gastrointest Surg 24(4):918–932
18. Roulin D, Donadini A, Gander S, Griesser AC, Blanc C, Hübner M, Schäfer M, Demartines N (2013) Cost-effectiveness of the implementation of an enhanced recovery protocol for colorectal surgery. Br J Surg 100(8):1108–1114
19. Stephen AE, Berger DL (2003) Shortened length of stay and hospital cost reduction with implementation of an accelerated clinical care pathway after elective colon resection. Surgery 133:277–282