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Original Article

Benchmarks in colorectal surgery: multinational study to define quality thresholds in high and low anterior resection

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Abstract

Background: Benchmark comparisons in surgery allow identification of gaps in the quality of care provided. The aim of this study was to determine quality thresholds for high (HAR) and low (LAR) anterior resections in colorectal cancer surgery by applying the concept of benchmarking.

Methods: This 5-year multinational retrospective study included patients who underwent anterior resection for cancer in 19 high-volume centres on five continents. Benchmarks were defined for 11 relevant postoperative variables at discharge, 3 months, and 6 months (for LAR). Benchmarks were calculated for two separate cohorts: patients without (ideal) and those with (non-ideal) outcome-relevant co-morbidities. Benchmark cut-offs were defined as the 75th percentile of each centre's median value.

Results: A total of 3903 patients who underwent HAR and 3726 who had LAR for cancer were analysed. After 3 months' follow-up, the mortality benchmark in HAR for ideal and non-ideal patients was 0.0 *versus* 3.0 per cent, and in LAR it was 0.0 *versus* 2.2 per cent. Benchmark results for anastomotic leakage were 5.0 *versus* 6.9 per cent for HAR, and 13.6 *versus* 11.8 per cent for LAR. The overall morbidity benchmark in HAR was a Comprehensive Complication Index (CCI®) score of 8.6 *versus* 14.7, and that for LAR was CCI® score 11.9 *versus* 18.3.

Conclusion: Regular comparison of individual-surgeon or -unit outcome data against benchmark thresholds may identify gaps in care quality that can improve patient outcome.

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Introduction

Colorectal cancer is one of the three most common malignancies worldwide[1]. Curative treatment is predominantly by surgical resection. The surgical procedures are frequently performed using standardized techniques. In recent times, improvements in postoperative recovery have been achieved by implementing minimally invasive (MI) surgical techniques and enhanced recovery after surgery (ERAS) programmes[2–6]. However, colorectal resections are still associated with high postoperative morbidity and mortality rates[7,8]. The magnitude of risk increases the closer the cancer is to the anal verge[9,10]. Postoperative morbidity has a great impact on patients' quality of life (QoL), as complications increase suffering, require further treatment or interventions, and delay return to work, which may add a financial strain[11–14].

Improvement by comparison is a standard approach in economics, referred to as benchmarking. By comparing with the benchmark—the best possible in the field—gaps between own performance and this quality threshold may be detected. This facilitates and promotes early counteractions that will eventually improve quality. There is a lack of standardized global benchmarks in surgery to serve as reference thresholds. The reported outcomes in colorectal surgery are commonly either from single-centre studies, country-specific national audits, or pooling of easily accessible data[15–18]. Unlike in economy, a systematized approach to ways of establishing valid benchmarks for surgical outcome has only recently been proposed[19]. This method suggests taking lowest-risk patients who were operated by most experienced surgeons, working in high-volume centres with access to the most current technologies and participating in research, from highly developed countries across the globe. So far, surgical outcome benchmarks for pancreatic, hepatic, and oesophageal resections, and the associating liver partition and portal vein ligation for staged hepatectomy procedure have been determined by using a 10-step approach[20–24]. The process of benchmarking is intended for any size hospital or individual surgeon. High-volume centres are solely recommended for establishing the benchmarks.

The objective of this study was to define quality thresholds—here referred to as benchmarks—for high (HAR) and low (LAR) anterior resections in colorectal cancer surgery to facilitate the assessment of individual centre's performance, in terms of multiple postoperative outcomes[19]. For these two procedures, benchmarking has particular value for outcome improvement, as they are mainly standardized, and, despite recent surgical and perioperative advances, still carry the risk of postoperative complications and death.

Methods

Study design

To establish the benchmarks for HAR and LAR, a recently published 10-step approach was used to create internationally valid benchmarks[19] (*Fig. 1*). Steps 1–4 entail selection of the desired procedure, and deciding how to specify the selection criteria for patients, centres, and outcome. The selected patient cohort should have the expected lowest risk of complications, referred to here as 'ideal patients'. To qualify as a benchmark centre, the hospital should carry out high volumes of the respective procedures (considering country size) and be involved in research as an indicator of leader in the field. For endpoints to be considered valid as benchmarks they should be readily available, commonly used, and clinically relevant to the procedure of interest (such as anastomotic leak, severe complications). Step 5 outlines that centres from at least 3 continents ought to be included for the benchmarks to be considered internationally valid. The more variability in an outcome value (for example, rates of severe complications between different hospitals), the more centres should be included. Steps 6–8 state how to contact candidate centres, identify the desired patients, and collect the necessary data. Step 9 explains the need to calculate the median value of each endpoint for each centre to guarantee that hospitals contributing larger cohorts do not influence the benchmark more than smaller ones. Step 10 describes calculation of the benchmark by determining the 75th percentile cut-off using the median results from each centre. This 10-step approach to determine a valid international applicable benchmark in surgery has been validated externally by a Delphi study[25].

Centre and cohort selection, as well as determination of quality thresholds (benchmarks), data collection, and benchmark calculation were executed according to this approach[19,25]. Patient and outcome data were anonymized and transferred

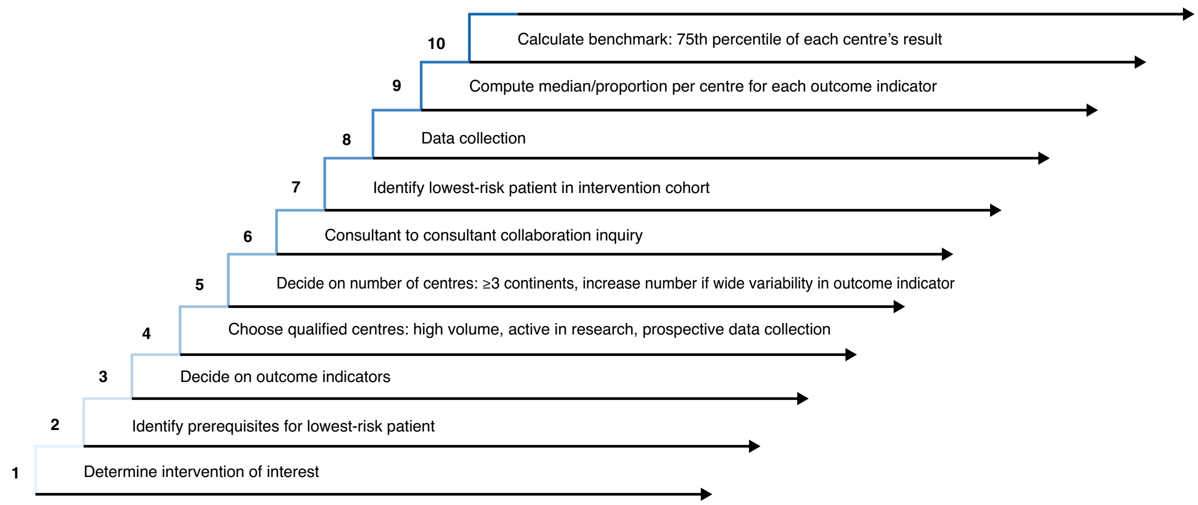

Fig. 1 **Ten-step approach to determining valid benchmarks in surgery**[19,25]

securely from the individual centres via the exchange platform provided by University Hospital Zurich (Transfer@USZ). They were stored in a secure password-protected home directory provided by the University of Zurich. Ethical approval was obtained from the Canton of Zurich, Switzerland (BASEC number Req-2018-00911) as well as by each participating centre according to the country-specific regulations.

Centre selection

Colorectal centres in Europe, Australasia, and North and South America were screened to identify high-volume units. No definition of high-volume centre in terms of a minimum number of procedures per year exists. As HARs are recorded as colonic resections in some countries, a minimum of over 250 colorectal procedures per centre per year or 100 colorectal procedures per individual surgeon per year was chosen (step 4). Individual collaborating surgeons' centres had to fulfil the requirement of more than 250 colorectal procedures per centre per year as well. A further requirement was the centre's administration of a prospective database for the selected procedures. Only missing data in the database were collected retrospectively (step 4). There was no restriction on the collaborating centres regarding the surgical platform used. The aim was to include more than 15 centres to cope with outcome variability (step 5). Hospitals with the above qualification were contacted by the investigators and invited to collaborate (step 6).

Patient selection

The study interval spanned 5 years, from January 2013 to December 2017. To determine the benchmark, the best possible outcome for cancer anterior resections, the advice was to include only patients who were expected to have the fewest postoperative complications based on their preoperative profile (step 2). The inclusion and exclusion criteria (Table S1a,*b*) for this selected group of patients were compiled from an extensive PubMed and MEDLINE search regarding factors previously established to be associated with surgical performance and increasing the risk of postoperative morbidity for these procedures[7,8,26]. In the present study, patients in this particular cohort are referred to as 'ideal patients'. Realistically, in most centres, only a few patients fulfil the requirements of an ideal patient. To be able to compare surgical outcomes of patients with risk factors for postoperative complications, the study further aimed to establish the best possible outcome for 'non-ideal patients' as a separate cohort. This included every patient who did not qualify as ideal (Tables S1a and S2). This cohort's benchmark results were expected to be inferior to the ideal benchmarks.

Cancer anterior resections were grouped into HARs, including high anterior and rectosigmoid resections, and LARs. This allocation was executed by the participating centres. The definition of HAR was rectal resection with anastomosis above the anterior peritoneal reflection. Rectal resections with an anastomosis below the anterior peritoneal reflection were considered LARs. Centres with slight variations regarding these definitions were also accepted, and applying these definitions did not lead to exclusion or reallocation of patients.

Outcome indicators

Benchmarks were defined for 11 specific postoperative variables chosen after literature review[8,26–28]. These parameters are commonly used in colorectal surgery as they are prevalent and regarded as clinically relevant. These included the occurrence of severe complications, overall postoperative morbidity (median and mean Comprehensive Complication Index (CCI®) score), mortality, prolonged ICU stay (≥ 3 days), and readmissions to indicate postoperative morbidity. For the surgeon's quality assessment, duration of operation, R0 resections, number of resected lymph nodes, anastomotic leak, and conversion rates were chosen. Benchmarks were determined at hospital discharge, 3 months after surgery, and also 6 months after operation for LAR, to help the user to identify which postoperative phase the deviation from the benchmark occurred in. Special emphasis was placed on the measure of morbidity, as it reflects postoperative outcome and health-related QoL more comprehensively than mortality. To assess overall morbidity, the CCI®[29–31] was used. This continuous metric model is based on the Clavien–Dindo classification (CDC)[32,33], and incorporates every complication graded according to the CDC. The CCI® reflects overall morbidity on a scale from 0 (no complication) to 100 (death). Unlike the CDC, the CCI® permits comparison of overall morbidity, and not only rates of minor or severe complications. It further facilitates observation of the morbidity progression over time, as additional complications can easily be added to previous CCI® points. Only information on the severity of complications was collected, not their specific type.

Five further parameters were assessed by the approach described above: duration of hospital stay, stapled anastomosis, diverting loop ileostomy, rate of postoperative chemotherapy, and diverting ileostomy reversal. However, owing to variation in healthcare practices, regional influencing factors, and surgeons' preferences, these were not considered as measures of quality but as additional information. The authors deliberately refrained from including further oncological outcomes, such as recurrence rate, time to recurrence, and overall survival time, as these outcomes are also affected by factors other than the quality of surgical care alone and cannot therefore be benchmarked by this approach. The advantage of benchmarking (comparison with the benchmark) in surgery is to recognize shortcomings that are amenable to improvement by making intraoperative and perioperative adjustments. Furthermore, although ERAS programmes have been established widely, treatment within such a programme was not an inclusion criterion for the cohort of ideal patients, as there are variations in implementation and adherence to an ERAS protocol is difficult to monitor[4].

Data assessment, statistical analysis, and definition of benchmarks

Microsoft® Excel (Microsoft, Redmond, Washington, WA, USA) and R studio (R Foundation for Statistical Computing, Vienna, Austria) were used for statistical analysis. The benchmark calculation was conducted based on steps 9 and 10 as follows. To guarantee each centre's equal impact on the benchmark, the median or proportion (binary) of every outcome indicator was calculated per hospital. Thus, smaller centres had just as much impact in determining the benchmark as larger ones. The 75th percentile of these median results was the benchmark cut-off, as proposed in step 10. In other words, every result better than the lowest 25 per cent is within the benchmark. This low cut-off is intended to create realistic quality thresholds, which are also achievable by low-volume centres. This approach was confirmed in the Delphi study[19,25].

Results

Nineteen high-volume centres from 5 different continents (11 centres from Europe, 3 from Asia, 2 North American, 2 South

American, and 1 from Australia) provided data on 7629 anterior resections for cancer within the 5-year study interval. A total of 3903 patients who underwent HAR and 3726 who had LAR were included, of whom 35 per cent represented ideal patients for HAR and 24 per cent for LAR (*Fig. 2*). Of the 23 centres that had agreed to collaborate, 4 had to be excluded owing to data-sharing restrictions or inability to provide data in the required time frame. The mean number of colorectal procedures performed per included centre during the study was 565 per year. Centres with fewer than 10 procedures in a group were excluded from this group's specific benchmarks. This applied to 2 centres in the ideal LAR group (the majority were non-ideal patients contributed from these centres). One centre was excluded from the follow-up benchmark results in HAR and LAR because of incomplete data. As the list of exclusion criteria for the ideal patient group was quite extensive (Table S1b), multiple centres contributed only small cohorts of ideal patients. This, however, reflects the clinical reality, especially in tertiary centres, where more complex cases are centralized.

To determine whether there is value in reporting benchmarks separately by cohort (ideal and non-ideal), surgical approach (MI and open surgery), and sex, the LAR data (expected to have higher morbidity) for each centre were first apportioned into ideal and non-ideal groups. In each of these groups, patients were stratified by surgical approach, and by sex. The mean CCI® score was compared across these groups (for example, ideal-MI-men *versus* ideal-MI-women, or non-ideal-open *versus* non-ideal-MI). A morbidity increase of 10 CCI® points has previously been determined to be clinically relevant[30]. No clinically significant difference was found between any of these groups. The biggest CCI® difference was found between ideal and non-ideal patients, not between surgical approach, sex, and a combination of both (*Table S3*). Therefore, it was decided to report benchmark values separately only for ideal and non-ideal patients, and not to differentiate between sex or surgical approach.

Benchmarks for high anterior resections

Benchmarks for HARs are listed in *Table 1*. During the index stay, the mortality benchmark was 0.0 per cent for ideal and 2.4 per cent for non-ideal patients. The benchmark for severe complications during the hospital stay was 8.8 per cent in the ideal patient group and 13.6 per cent in the non-ideal group. For average overall morbidity, the benchmark cut-off for non-ideal patients was twice that for ideal patients (mean 6.5 *versus* 12.4 CCI® points), and the leakage rate was comparable (5.0 *versus* 4.8 per cent). The benchmark for duration of operation was similar for the two groups (239 *versus* 240 min). For R0 resection and resection of more than 12 lymph nodes, the benchmark was higher for ideal patients. The benchmarks for conversion to an open procedure was more than twice as high (6.1 *versus* 14.5 per cent) and that for ICU stay over three times as high (3.0 *versus* 9.5 per cent) for non-ideal patients. Severe complications still occurred between discharge and 3 months after surgery. The benchmark was 3.0 per cent for ideal *versus* 5.3 per cent for non-ideal patients. Therefore, the overall morbidity benchmark increased to 8.6 *versus* 14.7 CCI® points at the end of 3 months of follow-up. The readmission benchmark was twice as high for the non-ideal group (5.3 *versus* 11.2 per cent). The mortality benchmark increased for the non-ideal group by 0.6 per cent during the 3 months follow up to a total of 3.0 per cent, and the

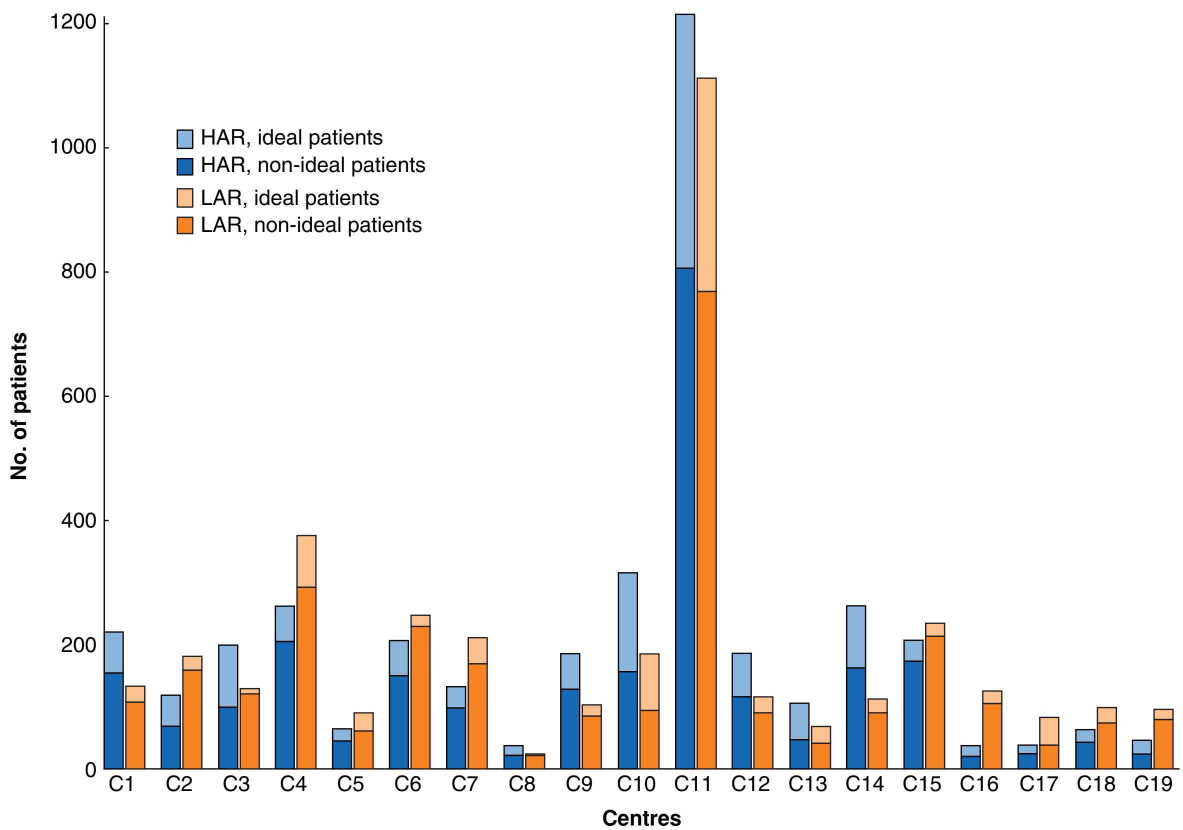

Fig. 2 **Number of ideal and non-ideal patients undergoing high and low anterior resections**

HAR, high anterior resection; LAR, low anterior resection.

Table 1 Benchmark results for ideal and non-ideal patients after high anterior resection

	Ideal patients		Non-ideal patients	
	HAR benchmarks	Range median per centre	HAR benchmarks	Range median per centre
At discharge				
Severe complications (%)‡	8.8	0.0–20.6	13.6	0.0–35.7
Median CCI® score	0.0	0.0–0.0	0.0	0.0–20.7
Mean CCI® score	6.5	0.0–15.2	12.4	2.3–29.2
Mortality (%)	0.0	0.0–3.5	2.4	0.0–0.1
Anastomotic leakage (%)	5.0	0.0–6.9	4.8	0.0–10.2
Duration of operation (min)	239	90–248	240	100–257
R0 resection (%)	95.0	89.5–100	86.8	78.6–100
> 12 lymph nodes resected (%)	77.4	61.1–100	72.2	47.7–100
Conversion to open procedure (%)	6.1	0.0–17.6	14.5	0.0–33.3
ICU stay ≥ 3 days (%)	3.0	0.0–100	9.5	0.0–97.7
Duration of hospital stay (days)§	7	3–8	9	4–13
Stapled anastomosis (%)§	87.7	25.0–100	78.7	27.3–100
Diverting ileostomy (%)§	2.0	0.0–72.0	4.2	0.6–56.4
Discharge to 3 months†				
Severe complications (%)‡	3.0	0.0-9.1	5.3	0.0–12.5
Median CCI® score	0.0	0.0–4.3	4.3	0.0–29.6
Mean CCI® score	8.6	0.5–16.4	14.7	2.8–31.6
Mortality (%)	0.0	0.0–3.5	0.6	0.0–2.6
Anastomotic leakage (%)	0.0	0.0–3.5	2.1	0.0–4.8
Readmission (%)	5.3	0.0–14.7	11.2	1.3–18.0
Postoperative chemotherapy (%)§	43.6	0.0–58.4	45.5	1.6–64.0
Stoma reversal (%)§	4.2	0.0–100	38.1	0.0–100

Benchmarks were calculated using the 75th percentile of each centre's median result. †One of 17 centres excluded because of healthcare system-dependent incomplete data for follow-up interval. ‡Clavien-Dindo grade at least IIIa. §Results not suggested as quality benchmark, rather as a reference point. HAR, high anterior resection; CCI®, Comprehensive Complication Index.

Table 2 Benchmark results for ideal and non-ideal patients after low anterior resection

	Ideal patients		Non-ideal patients	
	LAR benchmarks*	Range median per centre	LAR benchmarks	Range median per centre
To discharge				
Severe complications (%)‡	12.2	2.3–16.7	13.7	3.3–26.0
Median CCI® score	0.0	0.0–4.3	8.7	0.0–8.7
Mean CCI® score	8.4	3.0–11.6	14.2	4.2–16.6
Mortality (%)	0.0	0.0–3.7	1.1	0.0–5.3
Anastomotic leakage (%)	9.8	0.0–15.6	6.5	0.0–15.8
Duration of operation (min)	289	105–325	310	130–381
R0 resection (%)	92.1	83.3–100	89.0	74.0–100
> 12 lymph nodes resected (%)	74.5	65.5–100	68.3	54.3–94.7
Conversion to open procedure (%)	7.6	0.0–15.4	10.9	0.0–20.0
ICU stay ≥ 3 days (%)	4.3	0.0–96.6	15.1	0.0–100
Duration of hospital stay (days)§	8	4–10	10	5–10
Stapled anastomosis (%)§	85.5	52.9–100	76.3	58.0–100
Diverting ileostomy (%)§	36.0	4.2–88.2	59.5	22.2–100
Discharge to 3 months†				
Severe complications (%)‡	6.7	0.0–13.3	7.7	0.0–17.4
Median CCI® score	0.0	0.0–8.7	14.4	0.0–20.9
Mean CCI® score	11.9	3.7–14.8	18.3	6.0–21.9
Mortality (%)	0.0	0.0–0.0	1.1	0.0–1.7
Anastomotic leakage (%)	3.8	0.0–11.8	5.3	0.0–16.8
Readmission (%)	15.3	0.0–19.0	21.7	3.2–28.6
3 to 6 months†				
Severe complications (%)‡	4.4	0.0–7.1	4.7	0.0–8.2
Median CCI® score	0.0	0.0–8.7	20.9	0.0–20.9
Mean CCI® score	13.7	3.7–16.6	19.4	6.0–24.0
Mortality (%)	0.0	0.0–6.3	0.7	0.0–6.8
Anastomotic leakage (%)	0.8	0.0–4.3	1.0	0.0–2.6
Readmission (%)	4.8	0.0–9.5	5.2	0.0–8.8
Postoperative chemotherapy (%)§	38.3	0.0–62.5	55.4	0.0–81.8
Stoma reversal (%)§	80.9	62.9–100	69.8	40.0–98.5

Benchmarks were calculated using the 75th percentile of each centre's median result. *Two of 19 centres excluded owing to small sample size. †One of 19 centres was excluded because of healthcare system-dependent incomplete data for follow-up interval. ‡Clavien-Dindo grade at least IIIa. §Results not suggested as quality benchmark, rather as a reference point. LAR, high anterior resection; CCI®, Comprehensive Complication Index.

anastomotic leak rate benchmark by 2.1 per cent to a total of 6.9 per cent at 3 months after surgery. For ideal patients, the benchmark for mortality remained at 0.0 per cent, the leakage benchmark was 0.0 between discharge and 3 months' follow-up.

Benchmarks for low anterior resections

Benchmarks for LARs are listed in *Table 2*. For the occurrence of severe complications during the hospital stay, the benchmark was 12.2 per cent for ideal patients *versus* 13.7 per cent for non-ideal patients. The average overall morbidity benchmark was nearly twice as high for the non-ideal group (8.4 *versus* 14.2 CCI® points). The benchmark for operating time was 21 min shorter for ideal patients (289 *versus* 310 min), and the benchmark for conversion to an open procedure was 7.6 *versus* 10.9 per cent. The benchmark for anastomotic leakage was lower in the non-ideal group (9.8 *versus* 6.5 per cent). For ideal patients, the benchmark was higher for R0 resection and resection of more than 12 lymphatic nodes, and that for extended ICU stay was about four times higher for non-ideal patients (4.3 *versus* 15.1 per cent). The mortality cut-off values were 0.0 *versus* 1.1 per cent. During the 6-month follow-up, severe complications still occurred in both groups. This was further expressed in the average overall morbidity benchmark, which also continued to rise. The mortality benchmark continued to increase during the 3 months follow up for non-ideal patients by another 1.1 per cent in the first 3 months, and by 0.7 per cent between 3 months and 6 months of follow-up to a total of 2.9 per cent at 6 months.

Discussion

This study has determined internationally applicable postoperative quality thresholds (benchmarks) for HARs and LARs for cancer. The concept of benchmarking in surgery has recently been established, with the aim of defining postoperative quality thresholds that may serve as reference points for individual centres or surgeons, regardless of hospital size. For a clinician, it is important to have a quality reference to be guided by. Results from a single centre or even a national audit do not necessarily reflect the best possible result, rather the average. Furthermore, outcomes presented in a national audit of a European country may differ greatly from similarly gathered results in Asia or North America.

This study followed the approach of creating internationally applicable surgical outcome benchmarks, published in 2019 and validated in 2022[19]. These benchmarks reflect the lowest cut-off point for acceptable outcome. At an individual or unit level, any better result is considered to be within the benchmark, and any poorer outcome is considered to be below the benchmark. Practice that falls below the benchmark should then trigger internal review and countermeasures.

The most remarkable finding of these novel benchmarks is the unexpectedly high morbidity rate after HARs in patients with significant co-morbidities. This is reflected in the frequency of severe complications, mean overall morbidity score, as well as the considerably greater occurrence of prolonged ICU stays than for ideal patients. Furthermore, the high mortality benchmark of 2.4 per cent at discharge is striking. For practical use, this means that an individual centre's mortality rate in patients with co-morbidity undergoing HAR should remain at or below 2.4 per cent to be within the benchmark.

The cut-offs for operating time are comparable for ideal and non-ideal patients. This may be influenced by the lower reluctance to convert to an open procedure in a patient with co-morbidity, reflected by a higher conversion rate in non-ideal patients for both HAR and LAR. The anastomotic leakage benchmark at discharge was identical for HAR ideal and non-ideal cohort. This again is surprising, and may most likely be explained by the much smaller number of ideal patients per centre. Therefore, the occurrence of each leak weighs more heavily and is most likely the reason for this rather high result in the ideal group. In addition, the 75th percentile of each centre's median result was previously determined to be the cut-off for benchmark results[19,25]. This again leads to more extreme findings for smaller cohorts. A comparison of the 50th percentile, the median, confirms this reasoning and shows more plausible results: 0.6 per cent anastomotic leakage for ideal patients and 3.9 per cent for those with co-morbidity. The same applies to the anastomotic leak benchmark for LAR, where the leakage result in the ideal patient cohort was also higher than for the non-ideal patient group.

Considering that LARs carry a higher risk of a complicated postoperative course, it was unexpected to find the benchmark for the occurrence of severe complications at discharge after HAR to be as high as that after for LAR in non-ideal patients. Furthermore, the mean overall morbidity score was comparable in these two groups. Although the benchmark anastomotic leakage rate was 2 per cent higher at discharge after LAR, and 3 per cent higher after 3 months, compared with that after HAR in patients with co-morbidity, the CCI® (especially at discharge) does not reflect this. This leads to the interpretation that these leaks must have been treated conservatively and, therefore, not noticeably increased overall morbidity. Perhaps more unsettling is that the mortality benchmark for HARs in patients with co-morbidity was higher than that for LARs. Even after discharge, morbidity and mortality after HAR for patients with co-morbidity continued to increase. In trying to find the reason for this high morbidity and mortality after HAR in patients with co-morbidity, a distinct disparity between the frequency of diverting ileostomies was found; the benchmark for LAR was 60 per cent, whereas that for HAR was only 4 per cent. Such ostomies may lead to a milder clinical course and often prevent unplanned reoperations. The results highlight that HARs in patients with co-morbidity are not to be underestimated in their potential to carry significant morbidity and mortality. It is not possible to draw conclusions from the study data on how careful the preoperative optimization of each patient was, or whether there was potential for improvement in perioperative management. Based on the disparity between diverting ileostomy benchmark values, it may be useful to consider whether a more liberal threshold for fashioning an ileostomy, or even permanent colostomy in patients with co-morbidity undergoing HAR, would be beneficial. However, it should be noted that ileostomies carry a greater risk of short- and long-term complications, and a reduction in QoL.

There are limitations to this study. As data were collected by each centre individually, there was a risk of inter-rater variability. An attempt was made to reduce miscommunication and variability in data reporting by providing clear written instructions and preprogrammed spreadsheets. In addition, different treatment policies may have had an influence on patient allocation. For example, the data collected showed great variation in administration of preoperative chemoradiotherapy among the hospitals. This most likely increased the allocation into the non-ideal patient group. As previously noted[20,22], it requires greater skill to operate on non-benchmark cases, as co-morbidities, previous abdominal procedures or chemoradiation may influence both technical aspects of the individual procedure as well as the postoperative course. However, high-volume surgeons and centres are generally more accustomed to operating on complex cases. This may have benefited the benchmark results for non-ideal patients. Ideal patients were the minority in all the high-volume centres included. Although this reflects the clinical reality, it may have biased benchmark results for these patients, as discussed previously. It was not possible to include patient-reported outcome/experience measures in this study. Undoubtedly, future prospective benchmark determination projects should include patient-reported outcomes, even if subjectivity might make it more difficult to benchmark.

The novel quality benchmarks for anterior resections presented in this study may help centres identify undetected quality gaps in perioperative care. Special attention should be paid to non-ideal patients undergoing HARs.

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Disclosure

The authors declare no conflict of interest.

Supplementary material

Supplementary material is available at *BJS* online.

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European Colorectal Congress

28 November – 1 December 2022, St.Gallen, Switzerland

Monday, 28 November 2022

09.50
Opening and welcome
Jochen Lange, St.Gallen, CH

10.00
It is leaking! Approaches to salvaging an anastomosis
Willem Bemelman, Amsterdam, NL

10.30
Predictive and diagnostic markers of anastomotic leak
Andre D'Hoore, Leuven, BE

11.00
SATELLITE SYMPOSIUM
ETHICON
PART OF THE Johnson & Johnson FAMILY OF COMPANIES

11.45
Of microbes and men – the unspoken story of anastomotic leakage
James Kinross, London, UK

12.15
LUNCH

13.45
Operative techniques to reduce anastomotic recurrence in Crohn's disease
Laura Hancock, Manchester, UK

14.15
Innovative approaches in the treatment of complex Crohn Diseases perianal fistula
Christianne Buskens, Amsterdam, NL

14.45
To divert or not to divert in Crohn surgery – technical aspects and patient factors
Pär Myrelid, Linköping, SE

15.15
COFFEE BREAK

15.45
Appendiceal neoplasia – when to opt for a minimal approach, when and how to go for a maximal treatment
Tom Cecil, Basingstoke, Hampshire, UK

16.15
SATELLITE SYMPOSIUM
Medtronic
Further, Together

17.00
Outcomes of modern induction therapies and Wait and Watch strategies, Hope or Hype
Antonino Spinelli, Milano, IT

17.30
EAES Presidential Lecture - Use of ICG in colorectal surgery: beyond bowel perfusion
Salvador Morales-Conde, Sevilla, ES

18.00
Get-Together with your colleagues
Industrial Exhibition

Tuesday, 29 November 2022

9.00
CONSULTANT'S CORNER
Michel Adamina, Winterthur, CH

10.30
COFFEE BREAK

11.00
SATELLITE SYMPOSIUM
INTUITIVE

11.45
Trends in colorectal oncology and clinical insights for the near future
Rob Glynne-Jones, London, UK

12.15
LUNCH

13.45
VIDEO SESSION

14.15
SATELLITE SYMPOSIUM
BD

15.00
COFFEE BREAK

15.30
The unsolved issue of TME: open, robotic, transanal, or laparoscopic – shining light on evidence and practice
Des Winter, Dublin, IE
Jim Khan, London, UK
Brendan Moran, Basingstoke, UK

16.30
SATELLITE SYMPOSIUM
Takeda

17.15
Lars Pahlman lecture
Søren Laurberg, Aarhus, DK

Thursday, 1 December 2022
Masterclass in Colorectal Surgery
Proctology Day

Wednesday, 30 November 2022

9.00
Advanced risk stratification in colorectal cancer – choosing wisely surgery and adjuvant therapy
Philip Quirke, Leeds, UK

09.30
Predictors for Postoperative Complications and Mortality
Ronan O'Connell, Dublin, IE

10.00
Segmental colectomy versus extended colectomy for complex cancer
Quentin Denost, Bordeaux, FR

10.30
COFFEE BREAK

11.00
Incidental cancer in polyp - completion surgery or endoscopy treatment alone?
Laura Beyer-Berjot, Marseille, FR

11.30
SATELLITE SYMPOSIUM
EVOLUZIONE DISPOSITIVI MEDICI

12.00
Less is more – pushing the boundaries of full-thickness rectal resection
Xavier Serra-Aracil, Barcelona, ES

12.30
LUNCH

14.00
Management of intestinal neuroendocrine neoplasia
Frédéric Ris, Geneva, CH

14.30
Poster Presentation & Best Poster Award
Michel Adamina, Winterthur, CH

15.00
SATELLITE SYMPOSIUM
OLYMPUS

15.45
COFFEE BREAK

16.15
Reoperative pelvic floor surgery – dealing with perineal hernia, reoperations, and complex reconstructions
Guillaume Meurette, Nantes, FR

16.45
Salvage strategies for rectal neoplasia
Roel Hompes, Amsterdam, NL

17.15
Beyond TME – technique and results of pelvic exenteration and sacrectomy
Paris Tekkis, London, UK

19.30
FESTIVE EVENING

Information & Registration **www.colorectalsurgery.eu**