

Intestinal Ostomies Created During Emergency Surgery Possess Unique Challenges

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Abstract

Background: The surgical creation of an artificial opening of the bowel, called ostomy, can become necessary for very different causative diseases. A special subgroup are ostomies created during emergency surgery, which pose particular challenges to affected patients. This work is dedicated to their detailed characterization.

Methods: A retrospective analysis of surgical ostomy creations at an acute care university hospital and an online survey for patients with an ostomy were performed and evaluated.

Results: In our study, about one third of all ostomies were created during emergency surgery (37.4%). Compared to patients who received an ostomy during elective surgery, emergency patients had a higher ASA score and diagnoses requiring acute surgical care. Patients undergoing emergency surgery were more likely to have inadequate preoperative medical education (60% vs. 33.3%, $p=0.029$), and rarely received preoperative ostomy marking (4% vs. 79.2%, $p<0.001$). Emergency patients underwent minimally invasive surgery less frequently (26.8% vs. 51.3%, $p=0.001$), and showed a higher rate of peristomal wound dehiscence (9.9% vs. 2.5%, $p=0.028$). Accordingly, emergency ostomies often resulted in an overall reduction in postoperative quality of life.

Conclusion: Ostomies are often created during emergency surgery under suboptimal perioperative conditions. This results in higher complication rates and negative physical and psychological effects. Therefore, intensive interdisciplinary care is essential to provide the best possible care for patients affected by these artificially created intestinal outlets.

Key Points

- Approximately one third of all ostomy creations were performed during emergency surgery, often under less favorable conditions compared to ostomy creations during elective operations.
- The preoperative marking of the future ostomy position contributed significantly to the postoperative satisfaction of the patient with the ostomy position.
- Emergency ostomies showed a higher rate of postoperative wound dehiscence and, therefore, required special medical and nursing care.
- Emergency ostomies often resulted in a reduction of postoperative quality of life.
- A perioperative interdisciplinary collaboration between physicians, nurses, ostomy therapists and patient support groups significantly improved the care of patients with newly created ostomies.

Background

The term "enterostomy" or also briefly "stoma" or "ostomy" is derived from the Greek words enteron (enteron) "intestine" and stoma (stoma) "mouth" or "opening". It refers to a surgically constructed opening of a portion of the intestine through the abdominal wall, which serves to drain fecal excretions. Based on

this function, there are several synonyms, such as anus praeter naturalis = "extranatural anus" or artificial anus.

Current epidemiological studies on the exact incidence and prevalence of ostomies do not exist, but the number of ostomy carriers currently living in Germany is estimated at approximately 160,000(1). Nowadays, ostomies are most frequently created in Germany as part of the treatment for colorectal cancer(2). Additionally, operations for diverticulitis or chronic inflammatory bowel diseases can lead to the creation of ostomies. Ostomy creation is almost always accompanied by changes in the patient's postoperative quality of life. Those affected often describe negative influences on physical and mental health due to restrictions in everyday life and social stigmata(3, 4). The reduced quality of life is aggravated by ostomy-related morbidity, which usually results from surgically inadequately designed or unfavorably located ostomies, or from inadequate perioperative care(5). To date, ostomy creation remains a life-prolonging surgical challenge that is an integral part of everyday surgical practice. In the long term, this challenge can only be met by interdisciplinary care and close cooperation between colorectal surgeons, gastroenterologists, oncologists, general medicine physicians, psychiatrists, ostomy therapists, nurses, physiotherapists, occupational therapists and patient support groups for the benefit of all patients affected.

The emergency ostomy - a very special challenge

Ostomies are heterogeneous in many aspects: They are created during elective or emergency surgeries due to benign or malignant underlying diseases in curative or palliative intention. They are formed from small or large intestine, are constructed in a loop or terminal fashion, and remain temporarily or permanently on the patient's body(2). A clinically very relevant main classification criteria for ostomies is the urgency of the operation during which they are created. This has far-reaching consequences in terms of long-term ostomy-associated morbidity. Emergency ostomies have a worse short- and long-term outcome compared to elective ostomies. For example, U.S. studies report a complication rate of 55% for emergency ostomy procedures as opposed to 37% for elective ostomy procedures(5, 6). Approximately half of patients with emergency ostomies develop peristomal skin irritations or defecating difficulties postoperatively(7). A recent German observational study shows similar results. Braumann et al. report that a total of 61% of patients with emergency ostomies had ostomy-related complications, whereas only 52% of patients with elective ostomies had complications(8). Peristomal skin irritations and ostomy retractions were more common and more severe in the emergency ostomy group. These increased complication rates of emergency ostomies suggest the need for more intensive postoperative medical care, which results in increased health care costs. The present study deals with the specific perioperative challenges of enterostomies created during emergency surgery.

Methods

The electronic patient data management system of Charité - Universitätsmedizin Berlin was used to retrospectively select patient cases in which a surgery with ostomy creation was performed in a representative one-year period (September 2018–2019). For this purpose, the following operation and procedure codes were used: 5-460–5-463 as well as ostomy codes as part of the operation and procedure codes: 5-455, 5-456, 5-484. The search yielded 215 hits. Subsequently, the electronic patient files were reviewed manually. Data on patient age, physical condition, surgical diagnosis, urgency, procedure, type of ostomy and ostomy-associated complications were extracted and evaluated. Follow-up was one year.

In cooperation with *Selbsthilfe Stoma-Welt e.V.* an online survey was created, which was published in the ostomy forum and announced via social networks. Between August 23 and September 6, 2019, 73 fully completed questionnaires were registered and subsequently evaluated.

Statistical analysis was performed with IBM SPSS® version 25 (unpaired Student's t test, $p < 0.05$) and graphs prepared with GraphPad Prism® version 7.

Results

The emergency ostomy versus the elective ostomy

Our search in the electronic patient data management system yielded 215 hits (Fig. 1A), of which 25 patients ultimately received no ostomy (e.g., creation of a feeding fistula, incorrect coding, death during surgery). They were excluded from further analysis. Of the remaining 190 patient cases, 71 patients (37.4%) received an ostomy during emergency surgery and 119 patients (62.6%) received one during elective surgery. Emergency surgery was defined as surgery performed within 12 hours after initial presentation (N0 to N3)(9). However, in certain emergency settings we practice the surgical damage control strategy, which is intended to reduce the postoperative ostomy rate (10, 11). As in this surgical strategy ostomy creation is always performed in the planned second operation, these cases ($n = 22$) were grouped into the cohort of elective ostomy creations.

There were no age differences between patients with emergency ostomies and patients with elective ostomies (60.92 years versus 59.77 years, $p = 0.558$) (Fig. 1B). However, patients who underwent emergency surgery, as measured by the preoperatively determined American Society of Anesthesiologists (ASA) score, were more severely ill than patients who underwent elective surgery ($p = 0.001$) (Fig. 1C).

As expected, the underlying diagnoses requiring surgery differed (Fig. 1D). Emergency surgery was mainly performed for bowel obstruction (33.8%), intestinal perforation, ischemia (29.6%) or anastomotic dehiscence (16.9%). Elective surgery was performed for colorectal cancer (37%), other malignant diseases (24.4%) or benign inflammatory diseases (15.1%). The surprisingly high proportion of patients with intestinal perforation or ischemia as a surgical diagnosis in the cohort of elective surgery (17.6%) was almost exclusively due to patients operated on according to the damage control strategy.

In the group of patients with emergency ostomies, only 26.8% of patients underwent laparoscopic surgery (Fig. 2A), while in the control group, 51.3% ($p = 0.001$) underwent minimally invasive surgery. In both groups, loop and end jejunostomies, ileostomies and colostomies were created (Fig. 2B). No difference in the type of ostomy could be detected between emergency and elective surgeries ($p > 0.05$).

Ostomies created during emergency surgeries showed a higher rate of postoperative wound healing disorders than ostomies created during elective surgery (9.9% vs. 2.5%, $p = 0.028$) (Fig. 2C). An increased morbidity rate (ostomy retraction, bleeding, stenosis/defecation difficulty or other complication, e.g. high output ostomy, ischemia) was not observed in either of the two groups.

The ostomy survey

Of the 73 patients with ostomies participating in the survey, 25 patients (34.2%) received an ostomy during emergency surgery and 48 patients (65.8%) received one during elective surgery (Fig. 3A). Ileostomies ($n = 28$, 37.8%), colostomies ($n = 36$, 48.6%) and urostomies ($n = 10$, 13.5%) were created (multiple answers possible) (Fig. 3B). Especially in the group of patients with emergency ostomy creation, the preoperative medical education was in need of improvement (Fig. 3C). Only 40% of these patients stated that they had been sufficiently informed before surgery, compared to 66.7% of the patients in the comparison group ($p = 0.029$).

In only one single patient (4%) undergoing emergency surgery, the ostomy position was marked on the abdomen preoperatively (Fig. 3D). In contrast, this was done in 79.2% of patients undergoing elective surgery ($p < 0.001$). Accordingly, satisfaction with the ostomy position was lower in the group of patients with an emergency ostomy (40% vs. 77.1%, $p = 0.002$) (Fig. 3E).

There were no differences in postoperative care between the two groups. The vast majority of patients was instructed postoperatively to independently change their ostomy appliance (87.7%) (Fig. 4A) and reported sufficient instruction (81.3%) (Fig. 4B). Additionally, the majority of patients in both groups perceived ostomy care as rather or completely unproblematic (40%, 43.8% and 24%, 27.1%) (Fig. 4C). A total of 95.9% of patients stated that they were able to perform their ostomy care at home independently (Fig. 4D). However, 57.5% of those affected complained that their family medicine physician was insufficiently informed about the materials used in ostomy care (Fig. 4E).

Approximately half of patients (56.2%) stated that they were also actively performing sports (Fig. 5A). It was possible for 65.8% of patients to visit a swimming pool (Fig. 5B). Almost two thirds of the respondents (63%) still felt that an ostomy was associated with a social stigma (Fig. 5C). Therefore, ostomy creation was accompanied by a change in the quality of life for the vast majority of patients (Fig. 5D). Interestingly, however, the subjective direction of this change is different for patients in the two groups. About half of the patients with ostomies created during emergency surgery reported a postoperative worse (12%) or rather worse (40%) quality of life, whereas patients after elective surgery

reported a better (35.4%) or rather better (14.6%) quality of life. A total of 16.4% of the survey participants reported no change in their quality of life as a result of the ostomy.

Discussion

Emergency ostomies have a high clinical relevance

The creation of an ostomy is frequently necessary and mostly unavoidable during life-prolonging emergency or elective surgery. According to the retrospective analysis and survey presented here, emergency surgery accounted for about one third of all ostomy creations. However, one has to consider that these data were collected at a large university hospital treating a heterogeneous patient population. The survey was presumably completed by younger patients with more frequent diagnoses of chronic inflammatory bowel disease. Thus, our results cannot easily be generalized. Nevertheless, emergency ostomy creations make up a considerable proportion of all ostomies. It seems appropriate to pay special and detailed attention to this particular ostomy subgroup. This article specifically addresses the differences between ostomies created during emergency versus elective surgeries. In the following paragraphs, our analysis and survey results will be discussed and integrated into a wider context.

Emergency ostomies are created under difficult circumstances

Both medical and logistical circumstances are disadvantageous during emergency surgery. As expected, patients who received an ostomy during emergency surgery were more seriously ill at the time of surgery and had diagnoses with acute indication for surgery. The technical creation of the ostomy during an emergency surgery is more challenging and the patient is more susceptible to complications. Due to the urgency and the often-unfavorable time of day, less time and resources are left for preoperative medical education. It is difficult to provide comprehensive patient information without unsettling the patient. Likewise, the extent of the upcoming emergency surgery cannot be fully estimated preoperatively, which can lead to a lack of information and, thus, to a lower satisfaction of the affected patient. There is need for improvement. A comprehensive preoperative assessment of a patient prior to an ostomy creation includes knowledge of lifestyle, employment, clothing preferences, stool behavior and possible personal impairments.

Preoperative marking of the future ostomy position is extremely important

Only a single survey participant with emergency and only 79.82% of patients with elective ostomy creation had received preoperative marking of the future ostomy position. This is alarming, as all national and international guidelines explicitly recommend preoperative marking(5, 12, 13). Scientific evidence

suggests that the absence of marking is a risk factor for postoperative leakage and peristomal skin irritation(14, 15). It is preferred to have the future ostomy position determined by a certified ostomy therapist(5). However, marking can also be performed by an experienced surgeon, especially in emergency situations. In 2007, the American Society of Colon and Rectal Surgeons, together with the Wound, Ostomy and Continence Nurses Society, published a position paper on professional preoperative marking of the ostomy position(13). In addition to a detailed examination of the abdomen for shape, skin folds, scars, contractures, possible hernias or preexisting ostomies, and the position of the waist, patient-specific aspects such as age, mobility, occupation, and mobility (e.g., using a wheelchair or rollator) should also be considered. Based on these aspects, which will be assessed in the standing, sitting and lying position, and according to the type of ostomy planned, a transrectal ostomy site (to avoid a parastomal hernia or ostomy prolapse) will be selected that is clearly visible and accessible to the patient. A position below the waistline allows the ostomy appliance to adhere easily to the skin and to be concealed inconspicuously under clothing. In patients with very large or obese abdomens, an ostomy position in the upper abdominal quadrants may be necessary. It is important to find the most favorable ostomy position for each patient individually, taking into account underlying conditions, technical-surgical possibilities and these recommendations, so that the ostomy can be handled as unproblematically as possible.

Intraoperative challenges

Various pathophysiological factors significantly complicate the surgical-technical circumstances and can make ostomy creation highly demanding. The systemic dysregulation of the microcirculation during sepsis, for example, impairs the vitality of the intestine making it difficult to create a vital, well-perfused ostomy from a partially ischemic distended intestinal wall caused by a bowel obstruction(16). The mobility of the obstructed intestinal segment may be limited, impairing the tension-free mobilization of the intestinal segment sufficiently above the skin level. This can result in ischemia or retraction of the ostomy. An ostomy created from a dilated intestinal segment requires a larger fascial gap, which can become the point of passage of a parastomal hernia after the swelling of the intestinal segment has subsided. In contrast, elective surgery is not usually associated with pathophysiological imbalance or bowel obstruction.

Emergency ostomies were less frequently created during laparoscopic surgery. This is understandable, since emergency procedures are often performed openly for a variety of reasons (e.g. preoperatively unclear exact diagnosis or exact extent of pathology, massive adhesions due to previous operations, non-tolerance of the pneumoperitoneum, expertise of the surgeon). However, a laparoscopic ostomy creation is preferable over an open surgical approach, analogous to the general advantages of a laparoscopic visceral surgery(17): reduced postoperative pain, reduced need for opioid analgesia, earlier mobilization, faster return to normal stool behavior, shorter hospital length of stay and lower morbidity(18-20). Also, a recent study suggests that laparoscopically-constructed ostomies are more easily reversed than ostomies created during open surgical approaches(21).

Perioperative support by an ostomy therapist

Several studies have shown an advantage of perioperative care by a specially trained ostomy therapist (22, 23), which results in a faster ability to perform stoma care, a reduced rate of unplanned ostomy interventions, a shorter hospital stay and ultimately cost savings (14, 24). The German professional association *Stoma, Kontinenz und Wunde e.V.* developed a detailed advanced training curriculum. The perioperative training, practice and psychosocial support includes a variety of topics(5, 25): Preoperatively, the basic principles of gastrointestinal anatomy and physiology, the planned operation, possibilities of subsequent ostomy care, changes in lifestyle and psychological aspects should be discussed. Postoperatively, the anatomy and function of the ostomy, the characteristics of different ostomy appliances, the handling of leakage and peristomal dermatitis can be demonstrated, and dietary, clothing and leisure habits as well as psychological and sexual issues can be discussed. In this way, affected patients are given detailed instructions and support in dealing with their newly constructed ostomy.

Outpatient care

The majority of patients with an ostomy are able to change their ostomy appliance independently and without problems at home (Fig. 4C and D). However, there is often insufficient expertise of ostomy care by the family medicine physician (Fig. 4E). An important resource is the connection of those affected with a patient support group. These support groups produce and publish a wide range of information materials on ostomy care, facilitate regional and national networking among patients with the same problems, and participate in the training and further education of ostomy therapists at specialist congresses. In addition, patient support groups actively participate in health policy discussions on the legal framework for the care of patients with ostomies.

Conclusion

The creation of an ostomy is usually the last, and often considered trivial, step during a challenging visceral surgery. Sometimes the patient has to deal with this ostomy for the rest of his life. In particular, emergency ostomies present special challenges, which postoperatively manifest themselves in increased complication rates, social and psychological effects and, thus, lead to dissatisfaction of the affected patient. The most holistic and satisfactory perioperative care of the affected patient can therefore only be ensured in an interdisciplinary team of physicians, nurses, ostomy therapists, and patient support groups.

History Of Ostomies

Written records of the antiquity testify to the first ostomy creations(26, 27). Accordingly, the Greek physician *Praxagoras of Kos* created an artificial bowel outlet in a patient with incarcerated hernia in 350 B.C. However, the success of this surgical procedure remains uncertain due to a lack of records. In

modern times, French surgeons were the pioneers of ostomy surgery. In 1776, *Pillore* succeeded in creating an ostomy of the cecum in a patient with stenosing rectal carcinoma. In 1793, his French colleague *Duret* saved a three-day-old infant with anal atresia through a colostomy. Modern intestinal surgery was later decisively influenced by the doctors *Van Erckenlens* and *Maydl*. In 1879, *Van Erckenlens* published the first scientific study demonstrating the advantages of the surgical creation of an ostomy, thus helping it to achieve its breakthrough. A little later, the Viennese surgeon *Maydl* published his surgical method for creating double-barrelled ostomies, which is still used today with only a few modifications. Parallel to the further development of the surgical method, ostomy care was also developed. In 1954, the Danish nurse *Sørensen* invented the first self-adhesive, and thus sealed, disposable ostomy appliance, which enabled patients with ostomies an improved quality of life and participation in social life. At almost the same time, the importance of adequate medical and nursing care for ostomy patients was recognized. In 1958, the nurse *Gill* received her first employment as a so-called ostomy therapist at the Cleveland Clinic in the USA. The North American Association of Enterostomal Therapists, which was later renamed the Wound, Ostomy and Continence Nurses Society(25) was founded and is still one of the most important international professional nursing associations for ostomy therapists. In Germany, the patient support organization *Deutsche ILCO e.V.* was founded in 1972. Today, with about 7000 members and several hundred volunteers, it is the largest German solidarity community of ostomy carriers, patients with colon cancer and their relatives. After the foundation of the first German school for ostomy therapy at the University Hospital of Düsseldorf in 1978, there are now further training courses for wound and ostomy therapists at most German hospitals. In order to guarantee a nationwide uniform qualification as a nursing expert in ostomy, continence and wound care, the *Fachgesellschaft Stoma, Kontinenz und Wunde e.V.* as an umbrella organization has developed a detailed continuing education and examination curriculum.

Declarations

Ethics approval and consent to participate

This study was conducted in compliance with the international conference on harmonisation good clinical practice (ICH GCP) guideline. All data were collected as part of routine pre-, intra- and post-operative clinical management. All patients provided written informed consent for the use of their data for research purposes. The institutional review board (ethics committee) of Charité – Universitätsmedizin Berlin approved the present study (EA2/198/19).

Consent for publication

Not applicable.

Availability of data and materials

All data are stored on the institutional server of the Department of Experimental Surgery at Charité – Universitätsmedizin Berlin and are available from the corresponding author upon reasonable request.

Competing interests

The authors declare no conflicts of interest.

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Authors' contributions

WS designed study, performed data extraction, analysis and interpretation, and wrote the manuscript. IA performed data extraction. MK edited the manuscript. JP supervised the study. All authors read and approved the final manuscript.

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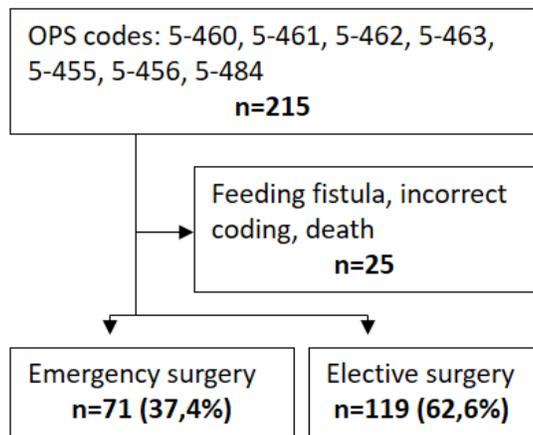
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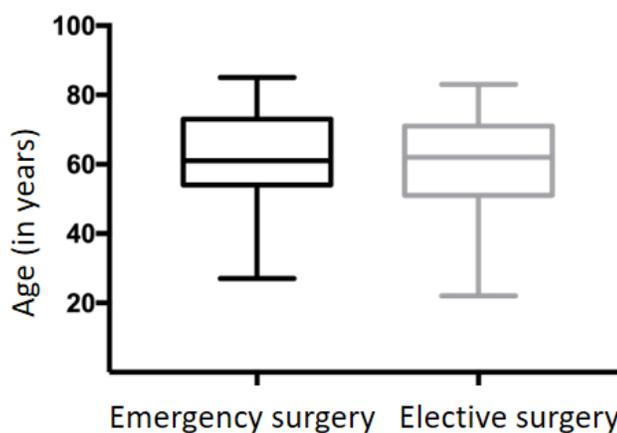
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Figures

A Patient selection

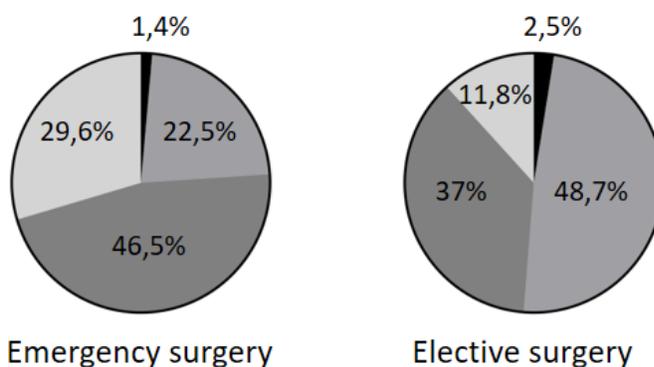


B Age



C ASA score

- ASA 1
- ASA 2
- ASA 3
- ASA 4



D Diagnosis

- Kolorektal carcinoma
- Other malignant disease
- Benign inflammatory disease
- Bowel obstruction
- Anastomotic dehiscence
- Intestinal perforation/ischemia
- Other

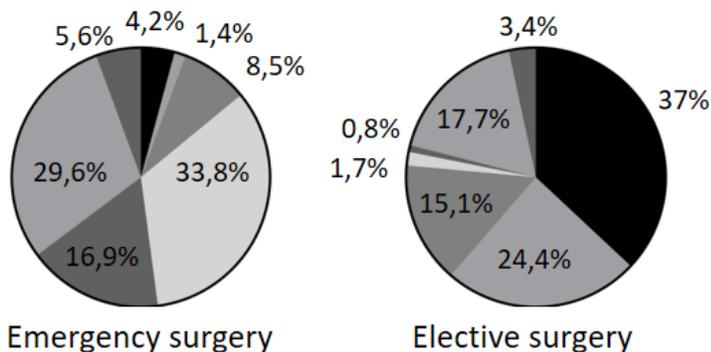
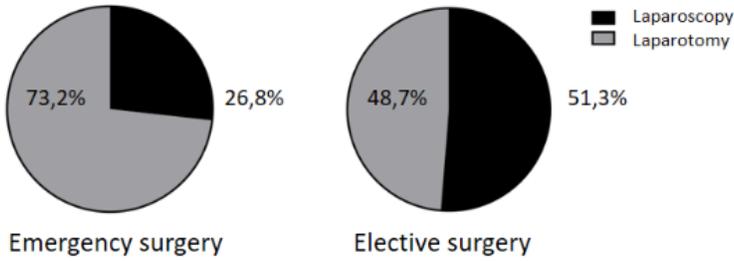


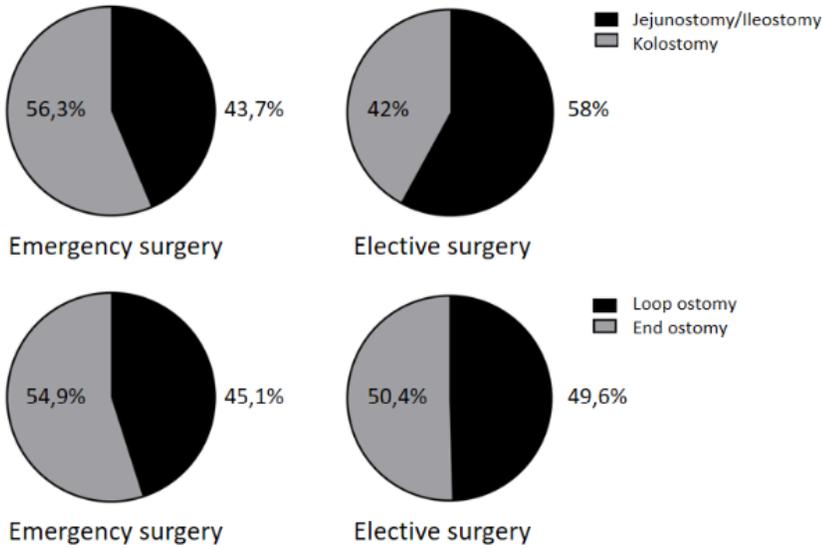
Figure 1

Ostomy creation during emergency versus elective surgery. Patient selection based on OPS codes (A), age distribution (B), distribution of ASA score (C) and diagnosis leading to the operation (D) during which the ostomy was created.

A Mode of surgery



B Ostomy type



C Complications

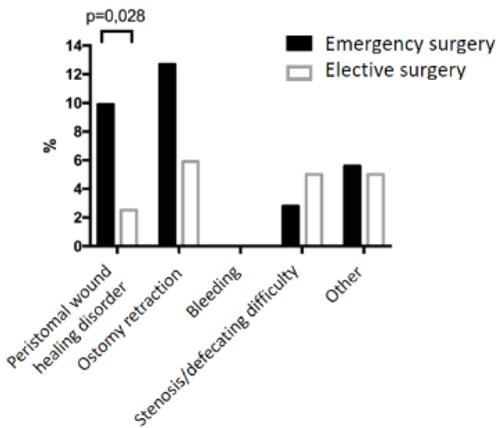


Figure 2

Ostomy characteristics after emergency versus elective surgery. Surgical method (A), type of ostomy (B) and ostomy-associated complications (C).

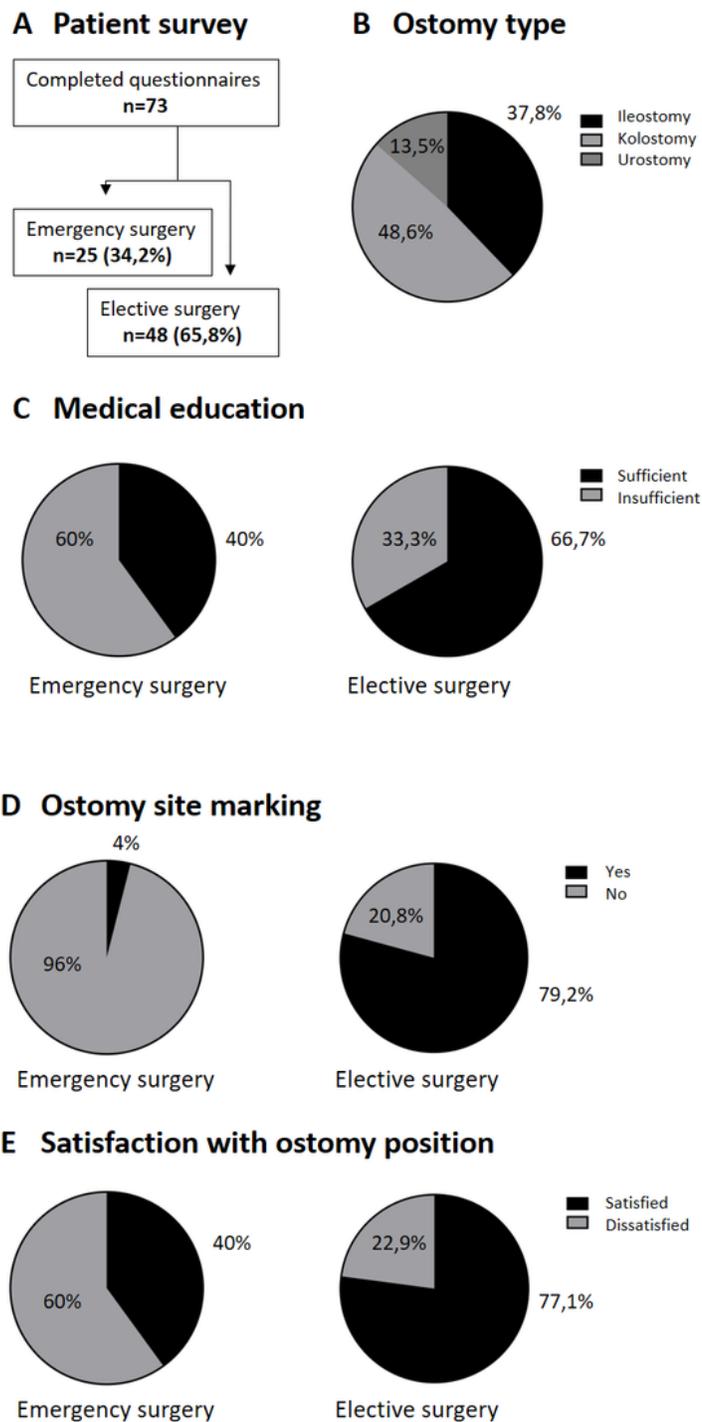
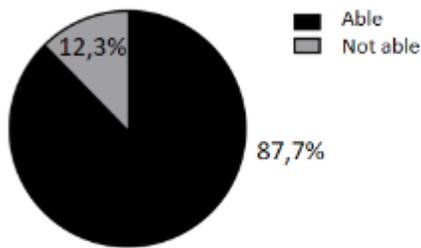


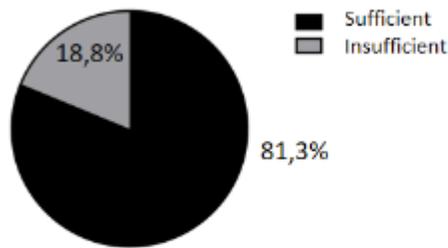
Figure 3

Ostomy survey. Division of mode of ostomy creation into emergency versus elective (A). Illustration of the type of ostomy (B), level of detail of the medical education (C), preoperative marking of the ostomy position (D) and the postoperative satisfaction with the ostomy position (E).

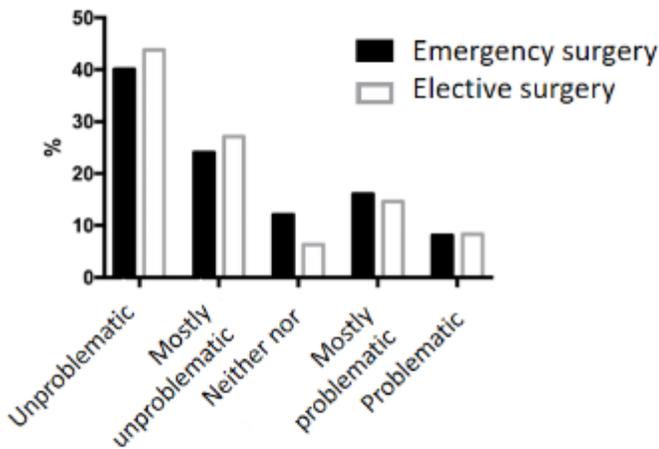
A Independent change of ostomy appliance



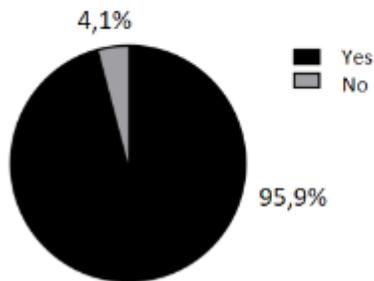
B Postoperative instruction in ostomy care



C Ostomy care



D Ostomy care possible at home



E Knowledge of family medicine physician on ostomy care

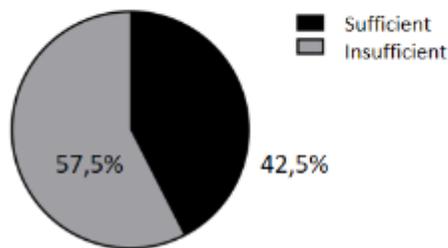
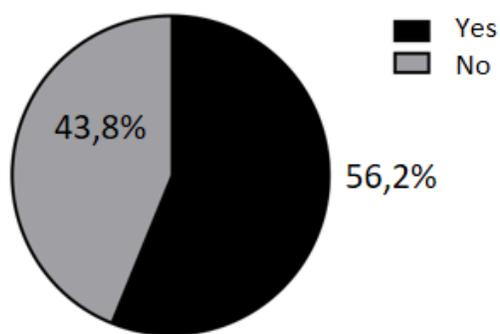


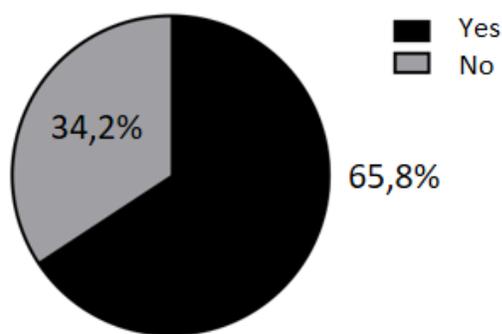
Figure 4

Ostomy care. Possibility of independent change of ostomy appliance (A), level of detail of instruction by specialized personnel (B), assessment of the overall practicability (C), especially at home (D), and the adequacy of the knowledge of the general medicine physician (E).

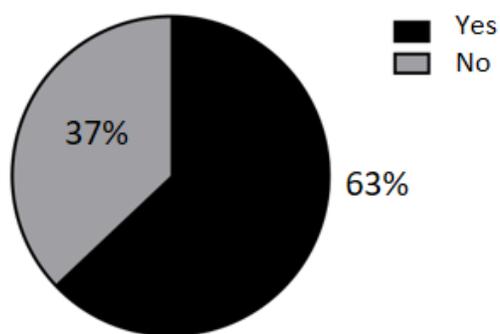
A Sports



B Swimming pool visit



C Social stigma



D Quality of life

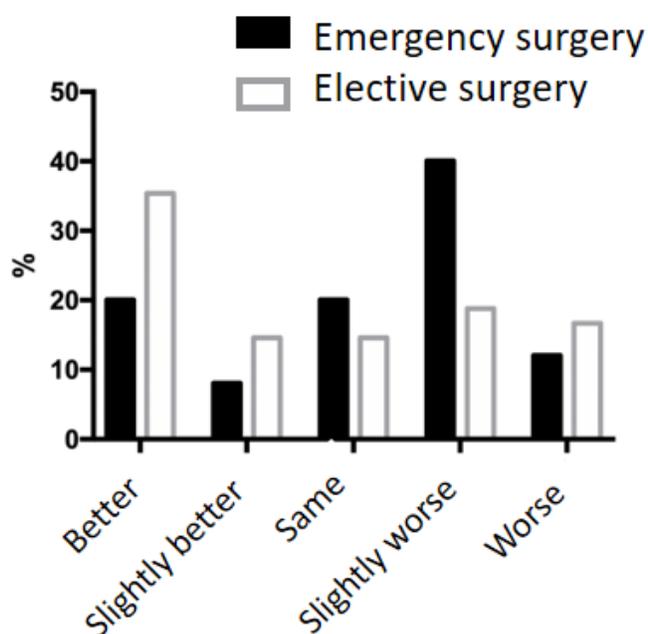


Figure 5

Postoperative quality of life after ostomy surgery. Possibility of physical activity (A) and swimming pool visits (B). Stigmatization of the affected patient after ostomy surgery (C) and quality of life after compared to before ostomy surgery divided into emergency versus elective surgery (D).

Supplementary Files

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