



Oncologic colorectal surgery in a general surgery unit of a small region of Italy – a successful “referral Centre Hub & Spoke Learning Program” very important to reduce mobility in the Covid-19 era

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Contributions: (I) Conception and design: All authors; (II) Administrative support: All authors; (III) Provision of study materials or patients: All authors; (IV) Collection and assembly of data: A Rocca, P Avella, MC Brunese, G Cecere; (V) Data analysis and interpretation: All authors; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

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Background: There are several evidences that underline a strong association between hospital volumes and outcomes in surgical approach and management of colorectal cancer (CRC). In Molise, a small region of Italy, to overcome the absence of a Cancer Institute or dedicated oncological units at “A. Cardarelli hospital” in Campobasso has been adopted an Hub & Spoke programs with oncological referral centers to best manage CRC patients avoiding sanitary migration to other region of Italy.

Methods: Cardarelli hospital started a “Teaching/Learning Model of Hub & Spoke Collaboration” between some referral centers for colorectal, liver and bariatric surgery. Cardarelli hospital sent patient’s data to the proctor colleagues to decide the correct indications and best select surgical strategies. In order to analyze outcome of the training model we retrospectively collected data of 208 patients who underwent colorectal surgery from January 2016 to December 2019. No exclusion criteria.

Results: From the beginning of the Hub & Spoke learning program 98 males and 70 females underwent to surgery. One hundred and seventy-eight CRC procedures were performed. Male to female ratio was 1.36. Mean age was 70 years (r.: 30–97 years). Mean BMI was 24.78 kg/m². The 21% of resections were performed laparoscopically. Conversion rate was 4.81%. The mean operative time was 118 min for open resection and 200 min for laparoscopic surgery. The mean hospital stay was 17 days counting admission before surgery, on the other hand mean discharge time was 11 PO. Re-intervention rate was 24/208 (11.5%). Mortality rate was 36/208 (17.3%), all died patients were ASA \geq 3 grade. One hundred and eight patients presented other comorbidity. Colorectal resections were also performed for other pathologies (40/208) like diverticulitis, Crohn’s disease, toxic megacolon and bowel ischemia. The tumor type was: 150/168 adenocarcinoma, 4/168 mucinous carcinoma and 14/168 signet ring cell carcinoma.

Conclusions: This pilot study has the goals to reduce the costs and the migrations for CRC in Molise.

Keywords: Colorectal cancer (CRC); Covid-19 pandemic; laparoscopic surgery; oncological surgery; Hub and spoke

Received: 05 August 2020. Accepted: 10 October 2020; Published: 30 December 2020.

doi: 10.21037/dmr-20-145

View this article at: <http://dx.doi.org/10.21037/dmr-20-145>

Introduction

Colorectal cancer (CRC) is the third most common tumor in the world (1.8 million of new case in 2018) and the second one in terms of mortality (880,000 deaths in 2018) (1). Molise is a small region of southern Italy near Rome and Naples, with only 250,000 (0.41% of Italian population) inhabitants, that counts only three major public hospitals which are dedicated to emergency and general surgery: “Antonio Cardarelli hospital” in Campobasso (Italy) is the Hub, then “San Timoteo’s hospital” in Termoli, (Campobasso, Italy) and “F. Veneziale’s hospital” in Isernia (Italy) which are spoke centers. Data concerning the trend of regional Molise incidence of this disease can be taken from the discharge schedule from hospital archives (2): the percentage incidence is 45 cases for males and 28.5 for females per 100,000 inhabitants. About CRC there are several evidences who are sufficient to underline a strong association between hospital volumes and outcomes in surgical approach for this cancer. Another important issue regarding colon cancer surgery regards single surgeon experience and complication rates like savage colostomy, fistulas, recurrence, hospital stay (3,4). Reading AGENAS report (5) we can find that the higher are surgical procedures the lower are mortality, complications, days before discharge and costs. About 30-day mortality after colon cancer surgery, it is significantly lower after 50/70 procedures/year (6). At least we shall consider that nowadays is level 1 evidence from major RCTs that laparoscopic-assisted surgery for colon cancer is as effective as open surgery and produces similar long-term outcomes like: comparable resections, longer op. time, less bleeding, faster recovery, less stress reaction, better preserved immunity, long-term survival—no difference, QoL favour laparoscopy (social functioning), hospital/health care costs favour open (7,8). Besides what we said above which regards the technical surgical point of view, we must underline how is changed the modern approach to oncologic patients. European Society of Surgical Oncology (ESSO) and Italian Society of Surgical Oncology (SICO) define the standard criteria to manage CRCs providing a multidisciplinary team building, a dedicated radiology and a dedicated pathological Unit (9). We present the following article in accordance with STROBE reporting checklist (available at <http://dx.doi.org/10.21037/dmr-20-145>).

Hub & spoke program

Due to the small number of inhabitants, in Molise there is not a formal regional plan dedicated to oncological surgical unit. So, because of the lack of an oncological surgery reference center and in order to reduce health migration and costs, the General Surgery Unit of the Hub Hospital A. Cardarelli in Campobasso started a collaboration with different referral centers of cancer surgery, in particular with those who deal with colorectal district. Antonio Cardarelli Hospital shows a good experience in emergency abdominal surgery; it also has an ICU, a unit of endoscopy and a unit of intervention radiology. In this process Giuseppe Cecere, chief of general surgery, played an important role: in fact, he was the first surgeon who moved to UK at St Mark’s Hospital in London to start a personal formal training program in colorectal surgery and laparoscopic surgery. At St. Mark’s he had the opportunity to improve his surgical skills, especially those concerning colorectal surgery, laparoscopic surgery and oncologic patient’s management. In this way, over the years, he has been able to expand clinical records and to train his collaborators. From 2016, following new colorectal surgery guidelines (6), an oncologic multidisciplinary team was built (oncologist; radiologist; radiotherapist; pathologist; surgeons), with the involvement of operating room staff and anesthesiologist, and the most challenging cases were discussed. The surgical staff was selected in order to answer to some needs, so few surgeons are referral for dedicated pathologies, like liver mets, oncological care, new technologies, wall reconstructions after surgery, bariatric surgery. Despite there are not formal agreements Cardarelli hospital started a “Teaching/Learning Model of Hub & Spoke Collaboration” between some referral centers for colorectal, liver and bariatric surgery. Cardarelli hospital sent patient’s data to the proctor colleagues to decide the correct indications and best select surgical strategies (10). Physicians discuss and treat the most difficult cases with Prof. Fulvio Calise chief of the HPB surgery Unit of “Pineta Grande Hospital” Castel Volturno, Naples, Italy and with colorectal surgery unit of “IRCCS-fondazione Pascale” Naples, Italy directed by Prof. Paolo Delrio. In this way we try to improve our experience and surgery skills with collaboration of tertiary referral center. The challenging cases are still operated or in Campobasso with

Table 1 Patient peri-operative baseline data and surgical outcomes

Characteristics of patients	Data
Sex	208
Male	120 (57.70%)
Female	88 (42.30%)
Age	70 (range, 30–97) years
BMI	24.78 (range, 17.34–38.95) kg/m ²
ASA grade	
ASA 1	12 (5.77%)
ASA 2	88 (42.31%)
ASA 3	60 (28.85%)
ASA 4	48 (23.07%)
Post-operative mortality (<30-days)	36 (17.31%)
Open surgery	164 (78.85%)
Laparoscopic surgery	44 (21.15%)
Converted	10 (4.81%)
Colorectal cancer	168/208 pt (80.77%)
Male	98 (58.33%)
Female	70 (41.66%)
Other pathologies	
Diverticulitis Hinchey 4	26 (12.50%)
Diverticulosis with stenosis	2 (0.97%)
Crohn's disease	4 (1.92%)
Toxic megacolon	4 (1.92%)
Intestinal ischemia	4 (1.92%)
Tumor type, (n/ntotal)	
Adenocarcinoma	150/168 (89.28%)
Mucinous carcinoma	4/168 (2.38%)
Signet ring cell carcinoma	14/168 (8.33%)
Colorectal cancer procedures (overall no. 178)	
Right colectomy	76 (42.70%)
Left colectomy	44 (24.72%)
Hartmann	24 (13.48%)
RAR	18 (10.12%)
Sigmoidal resection	10 (5.62%)
Trasverse colectomy	2 (1.12%)
(Sub)total colectomy	2 (1.12%)
Miles resection	2 (1.12%)

a surgeon tutor guidance or in the referral center where Campobasso's surgeons are involved. In 2020 we started different protocols to study benefits of Hipec (hiperthermic intraperitoneal chemotherapy) treatment for carcinosis and a formal ERAS protocols (11) (enhanced recovery after surgery).

Methods

This retrospective study is based on the data of our personal experience. We retrospectively collected data from January 2016 to December 2019 at our tertiary care center. 208 patients were enrolled. We included all patients who underwent colorectal surgery in the period. No exclusion criteria. We analyzed data on patient baseline characterizes, tumor location and size, colorectal surgical procedures, tumor type, length of hospital stay, post-operative mortality (30 days). Potential patient-specific and intraoperative risk factors for surgery were recorded like: gender, age, American Society of Anesthesia (ASA) score, surgical indication (cancer, chronic inflammatory bowel disease, diverticular disease, toxic megacolon, intestinal ischemia), open or laparoscopic approach. All patients underwent under general anesthesia and orotracheal intubation. Antibiotic therapy was performed 1 h before surgery (ceftriaxone 2 g i.v.). If necessary, nasal-gastric tube was placed and it is removed just after the end of operation. Post-operative pain was registered at 6, 12, and 24 h. Overall median follow-up time was 12 months (range, 0.2–36 months). All quantitative values were expressed as mean and range.

The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration (as revised in 2013), and has been approved by the authors' institutional review board or equivalent committee. Informed consent has been obtained from all individuals included in this study.

Results

208 patients underwent colorectal surgical resections, 168/208 (80.77%) were affected by CRC at histopathological findings. In the other 40 cases colorectal resections were performed diverticulitis, Crohn's disease, toxic megacolon and bowel ischemia. Male to female ratio was 1.36. Mean age was 70 years (r.: 30–97 years). Mean BMI was 24.78 kg/m². The baseline characteristics of patients are

Table 2 Post-operative morbidity and length of stay

Hospitalization time, median [range]	17 [2–30] days
Post-operative hospital discharges [range]	11 [2–26] days
Post-operative mortality (<30 days)	36 patients
Re-operation rate	24 patients

shown in *Table 1*. The median estimated intraoperative blood loss was 200 mL. Ten patients (4.81%) were converted to open surgery for intraoperative complications. The median operative time was 118 min (r.: 80–300 min) for open resection and 200 min (r.: 130–410 min) for laparoscopic surgery. Ileo-colic or colo-colic anastomosis were performed either manual in double layer either by staplers, colorectal anastomosis were always performed by circular stapler following a Knight and Griffen technique. In the last year at the end of the tutoring period we performed in only two patients a total intracorporeal ileo-colic anastomosis without any complication. Oral intake started after flatus in the 2016–2017, then we started oral intake in the II day P.O according to fast track protocols. The median length of stay was 17 days (r.: 2–30 days) if we consider the admission before surgery, mean post-operative hospital discharges was 11 days (r.: 2–26 days). Post-operative 30-day mortality was 36/208 (17.3%) patients as shown in *Table 2*. Thirty of 38 died patients were ASA III–IV >80 years old patients who underwent surgery for bleeding or occlusion due to CRC. In these emergency cases laparoscopic approach have been never adopted. Re-intervention rate was 24/208 (11.65%) due to post-operative bleeding in 15 patients and post-operative fistula in 9 cases. One hundred and eight patients (52%) presented other comorbidities at admission as depicted in *Table 1*. Abdominal drainage had always been placed since 2018, then we started a fast track protocol under tutoring, so we placed drainage only in case of intraoperative bleeding, or difficult anastomosis. The right colectomy was the most commonly performed operation (76/178 colorectal resections, 42.70%), 150 (89.28%) histopathological findings showed an adenocarcinoma, 14 (8.33%) showed a signet ring cell carcinoma and 4 (2.38%) were mucinous carcinoma.

Discussion

Nowadays surgical techniques are constantly improving. The diagnostic workup, the therapeutic approach and the final results are today characterized by considerable differences on the territory. According to a study of 2016

conducted by Ruffo *et al.* (6), the volume of interventions is one of the most significant measurable characteristics associated with quality of surgery results. It impacts favorably in terms of prognosis; reduce mortality, morbidity, length of stay and functional outcome.

For what concerns CRC this positive association volume-outcome appears stronger for individual surgeon, but it is not strictly related to perioperative mortality. Concerning this endpoint, the median threshold seems to be around 80 cases/year in colon cancer (6). So, following criteria shown in literature, the requirements established for the adequacy of a center lead to a centralization of surgical services. This implies unavoidably an increase of interregional mobility and related health care costs, especially for patients from region of intern areas, such as Molise.

The benefits of these Hub and spoke program surely consist in a reduction of health migration and costs and a decrease in waiting times for surgery (12). During Covid-19 pandemic, as we know from this survey written by Aldrighetti *et al.* on HPB surgery and Caricato *et al.* on CRC surgery in Italy, 72.8% of HPB centers showed a reduction of routine elective operations $\geq 50\%$ and CRC centers showed a reduction of elective surgery among 30% (13–15). In this situation a teaching-learning agreement become even more important to overcome the impossibility to send patients to tertiary referral centers, considering their overload, ensuring to patients a high-quality service at the same time. Our approach led us to guarantee effective treatment and safety procedures during the critical pandemic period. Analyzing our results, the laparoscopic approach around 20% of patients treated is under the mean range of referral centers and 30 days mortality is quite high 18% considering what it is reported by multicenter studies (16,17). Nevertheless, we have to consider that it depends on the characteristics of patients treated. The median age is set on 70 years, more than 80% belongs to ASA grade III–IV. Furthermore, these data are also influenced by patients treated in emergency regime. On the other hand, all ASA I–II patients who underwent elective surgery were approached laparoscopically. It must be also considered the learning program is still extended to a limited number of physicians who are enough skilled in minimally invasive and Colorectal surgery. Moreover, our reoperation rate (24/208 patients) is 11.65% a little bit lower than we found in literature (14,17–21).

Hospital stay is quite long, especially if we consider the modern fast track approach linked to ERAS protocol (11), but in Molise is quite difficult for many old patients to be followed in a one day hospital service before surgery

so we have to perform pre-operative work-up during hospitalization and late discharge also to best manage all the peri-operative period.

Conclusions

This is a pilot study which have the aim to share an experience of a single center from an internal area of southern Italy who is trying to reduce migration and costs ensuring the standard of care in oncologic colorectal surgery. The learning program is still going on and we expect a fast and exponential grow of new goals to reach the gold standard of care for several specialty. This attempt seems to be very effective especially during Covid-19 pandemia.

Acknowledgments

This work was written thanks to the patient's database of the General Surgery Unit "Antonio Cardarelli" Hospital of Campobasso, Italy.

Funding: None.

Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at <http://dx.doi.org/10.21037/dmr-20-145>

Data Sharing Statement: Available at <http://dx.doi.org/10.21037/dmr-20-145>

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/dmr-20-145>). AR serves as an unpaid editorial board member of *Digestive Medicine Research* from Apr, 2020 to Mar, 2022. The other authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration (as revised in 2013), and has been approved by the authors' institutional review board or equivalent committee. Ethical committee approval was not needed for anonymous retrospective data. Informed

consent has been obtained from all individuals included in this study.

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doi: 10.21037/dmr-20-145

Cite this article as: Rocca A, Avella P, Scacchi A, Buondonno A, Civerra M, Di Marzo G, Calise F, Delrio P, Brunese MC, Cecere G. Oncologic colorectal surgery in a general surgery unit of a small region of Italy—a successful “referral Centre Hub & Spoke Learning Program” very important to reduce mobility in the Covid-19 era. *Dig Med Res* 2020;3:44.