EDITORIAL

ARTERIAL STUMP MEASUREMENT: QUALITY INDICATOR IN COLORECTAL SURGERY

Measuring quality of surgery in colorectal resections for cancer has become an important subject of research since the principles of total mesorectal excision (TME) for rectal cancer and complete mesocolic excision (CME) for colon cancer have been brought forward. CME surgery proved to decrease local recurrence in colon cancer to 3.3% (1, 2). Similarly, TME was shown to drastically improve surgical outcomes in rectal cancer.

CME as described firstly by Hohenberger *et al*.(1) is based on three principles: (1), mobilizing the colon in the natural, embryological planes, maintaining an intact, spillage-free mesocolon; (2), ligation of the main vascular pedicle at its origin (i.e., central vascular ligation - CVL), ensuring removing the entire mesenteric root along with the central lymph nodes and (3), adequate distal and proximal margins of at least 5 cm.

While the intact dissection of the mesocolon and ensuring negative longitudinal margins has become well standardized and adopted by most surgeons, controversies still exist on the ideal location of CVL and whether CVL does actually impact survival. Adequate trials to define the ideal CVL point at which recurrence rate is improved compared to conventional surgery are lacking mainly because measurable indicators are not well standardized. One may predict the point of CVL indirectly by measuring the distance from the margin of the tumor to the apex of the specimen, but we must be aware of the natural anatomical variability in mesocolic area and pedicle length among patients, which will bias results.

One simple, non-invasive way of measuring the point of CVL and thus predicting the extent of apical lymph node dissection is to measure the length of the arterial stump on postoperative contrast enhanced computed-tomography (CT) scans. This is the most direct way of comparing oncological outcomes between CVL and non-CVL colectomies and can be done even in a retrospective manner. Both the ileocolic artery (ICA) and inferior mesenteric artery (IMA) stumps are readily visible on standard CT scans which are part of the routine colorectal cancer follow-up. Although it seems an innovative, simple technique, and we have tested its feasibility in our own previous studies (3, 4), it has yet to reach significance in clinical practice. Currently on PubMed there are seven original articles (3, 5-10) which tested the value of arterial stump measurement as a surgical quality marker.

Stump measurement: is it difficult?

The most valued trait of arterial stump measurement it`s the simplicity of assessing the length on routine postoperative CT's, which are already done as a standard cancer follow-up, thus measurements can be done retrospectively, and lengths can be easily linked to survival of patients. While some studies performed mesenteric enhanced CT's, in our experience this is not

required. Apart from the visible contrast, arterial stumps can be identified due to tip granuloma which appears at the ligation point, or, if clips are used, then measurement becomes even easier, by visualizing the radiopaque clip at the tip of the contrast enhanced stump. Most studies used experienced radiologists to perform stump measurements, mainly to improve reliability of results, but this can be done by surgeons as well if they are used to analyzing CT images of colonic anatomy in their practice. In general, surgeons are able to identify the correct stump length in at least 80% of cases when the radiologists' measurement is considered the benchmark length. On the right side, the superior mesenteric vein (SMV) and superior mesenteric artery (SMA) are identified. The ICA stump is identified as the last vessel arising from the SMA on the right side. On the left side, the inferior mesenteric artery (IMA) can be identified at the level of the 3rd lumbar vertebrae with a left trajectory. The stumps are measured from their origin to the clip or, if a clip was not used, a suture granuloma is usually visible. Overall, none of the included studies had issues or discussed technical difficulties in measuring the arterial stump both at the right and left colon.

Arterial stump:
marker of surgical quality?

Correct reporting on surgical specimens has become a requisite in any cancer centre. The advent of CME and TME and their impact on recurrence rates in colorectal cancer has made institutions to audit their specimens and ensure an adequate standard is met. Currently, measurements on fresh specimens are the norm and proved to predict outcomes. In our practice, among other institutions, stump measurement has become, so far, a complementary indicator of extent of resection. It is logical to assume that stump length is inversely proportional to all other macroscopic pathological measurements on the specimen, as the stump is anatomically part of the specimen, representing the tip of the pyramid both on the right and left colon, thus a shorter stump will naturally lead to a longer and wider specimen, a longer distance from the tumor to the apical vascular tie and a higher lymph node yield. All these pathology measurements proved to have prognostic implications and are regarded as standard indicators for quality of surgical specimens. For clinicians to embrace and use stump measurement as a quality marker, one must prove it has the same sensitivity and specificity while being easier to measure by non-pathologists.

Arterial stump: prognostic marker?

Hypothesizing that the stump length could correlate with the rate of local and/or systemic recurrence is an intriguing scenario. Increasing number of studies praise the importance of apical lymph node dissection especially in cN+ tumors, where the rate of central lymph node metastasis is higher11-15. In patients with positive central lymph nodes leaving a short arterial stump (less than 1.5cm) is recommended in avoiding local and systemic recurrence (17, 18, 19). More so, only by leaving a short stump, surgeons can manage to dissect the mesocolon fully intact up to its root. Some argue that leaving a longer stump while still performing central lymphadenectomy is and adequate replacement (20, 21, 22). This holds true for early stage cN0 cancers, where positive lymph nodes at the edge of the mesentery are very unlikely; however, in more advanced tumors complete meso-

colic excision up to the root of the peritoneum is the standard procedure with the best recurrence free survival rates and this can be achievable only by ligating the main pedicle at its origin leaving a small stump. Thus, arterial stump length may be regarded as an indirect marker of CME and CVL. Despite this, no study in current literature analyzed the prognostic implications stump length and this should be addressed. If the stump length proves to predict survival, then it would be a simple adjunct tool to assess whether a patient would benefit from adjuvant treatment.

In conclusion, postoperative arterial stump measurement after colorectal resections seems to be a simple tool to assess surgical quality, however the evidence is poor. Institutions that practice stump measurement should retrospectively compare the stump length with other pathology measurements and, more importantly, to assess whether leaving a shorter stump has an impact on recurrence free survival and, if it does, then a minimal accepted length should be brought forward.

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