МЕДИЦИНСКИЕ НАУКИ

ASSESSMENT OF LARGE-INTESTINAL SEGMENT PERFUSION BY INDOCYANINE GREEN ANGIOGRAPHY IN LAPAROSCOPIC TOTAL MESORECTAL EXCISION (TME)

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ABSTRACT

Colon cancer is one of the most common gastrointestinal cancers worldwide. The incidence of colorectal cancer has been increasing year by year, and oncologic outcomes have been improved by the development of surgical techniques and chemotherapy regimens in Baku. However, despite the improvement of surgical techniques and postoperative care, anastomotic complications still occur at a rate as high as 10 ~ 20% .

Key words: assessment, cancer, segments, quantitative analysis.

Introduction:

It is known that 10% of the population has poor development of the collateral circulation branches around the splenic flexure of the colon[1–4], and these differences in the vascular anatomical structure can lead to colonic ischemia in some patients after colorectal surgery [2–7]. Acute ischemia at the anastomosis can lead to anastomotic leakage or colon necrosis [8]. Chronic ischemia may cause anastomotic stricture, requiring reoperation [9, 10].

The most commonly used method for evaluating colonic perfusion is for the surgeon to observe the color change or pulsation of small blood vessels on the colon wall with their own eyes [11–13]. Sometimes, it is not easy to accurately detect minute changes in the microcirculation of the colon wall by visual observation. Especially when blood vessels are buried in fat tissue due to visceral obesity, even experi- enced surgeons can have significantly reduced accuracy in assessing colonic perfusion [12, 14].

The recently developed fluorescence camera system using indocyanine green (ICG) can be used to easily observe the perfusion status of the colon during robotic or laparoscopic surgery. In previous studies, the effects of using ICG fluo- rescence to protect from anastomotic complications have not been clearly demonstrated [15–17]. There is a limit to predicting colon ischemia by only qualitatively evaluating ICG fluorescence expression. Even if ICG fluorescence is expressed in the large intestine, colonic ischemia may occur if the blood flow rate is lower than the physiological requirements. Reliable quantitative analysis for predicting anastomotic complications is still not sufficient, and until now there have been many limitations in clinically applying the quantitative analysis of ICG fluorescence in the surgical field [14]. Recently, research on the quantitative analysis of colonic perfusion status has been continued in some institu- tions [15–17].

The goal of this study is to quantitatively evaluate colon perfusion patterns using ICG angiography to find the most reliable predictive factor of anastomotic complications after laparoscopic colorectal surgery.

Metods. This study aimed to quantitatively evaluate colon perfusion patterns using indocyanine green (ICG) angiography to find the most reliable predictive factor of anastomotic complications after laparoscopic colorectal surgery. Laparoscopic fluorescence imaging was applied to colorectal cancer patients ($n = 28$) from July 2014 to December 2015. ICG (0.25 mg/kg) was slowly injected into peripheral blood vessels, and the fluorescence intensity of colonic flow was measured sequentially, producing perfusion graphs using a video analysis and modeling tool. Colon perfusion patterns were categorized as either fast, moderate, or slow based on their fluorescence slope, $T_{1/2MAX}$ and time ratio (TR = $T_{1/2MAX}/T_{MAX}$). Clinical factors and quantitative perfusion factors were analyzed to identify predictors for anastomotic complications.

Results The study was carried out on the basis of the analysis of the results of fluorescent images of 28 patients who were diagnosed with rectal adenocarcinoma of various degrees and laparoscopic TME was performed. Using the fluorescent curve, T ½ max, and the time ratio (TR=1/2 T max/Tmax) of the graphs, the colon fluorescence intensity was estimated to be weak, medium, or high. For the study of anastomosis failure analyzed all the clinical factors at the same time.

For safe anastomosis JCG-perfusion is the most effective indicator. With the help of JCG-images in 29.7% of cases it is possible to avoid erroneous transection. On the basis of only qualitative indicators can not be sure of the reliability of the anastomosis. In this case, the complications associated with anastomosis are 10.7%. Serious complications may occur in 12.5% (1/8) of patients with a displaced transection line. Using perfusion factors such as T ½ max, TR and F max, it is possible to predict anastomoses in advance. Of the patients under our supervision (in total 28 people), T ½ max < 18 sec was observed in 75% of patients, T ½ max > 18 sec – in 21.4% of patients. Больные с быстрой и средней (скоростью) перфузией по показателю TR составляли 95.2% (TR<0.6), а больные с низкой перфузией – 4.8% (TR>0.6). Safe anastomoses were

applied in both groups of patients (safe and intermediate zone). In 16.7% of cases in patients with low perfusion (TR<0.4), which was imposed a safe anastomosis, there was a narrower of the anastomosis, in 33.3% of cases in patients with medium perfusion (0.4<TR<0.6) (critical zone) there were complications associated with anastomosis. Low perfusion was observed in 33.3% of patients under our supervision. Due to the fact that both of these patients (2/2) had intestinal necrosis, the transection line was re-displaced, in 1 patient anastomosis failure was noted. When Tmax 51,5>, T1/2max 19,8>, slope 1,7<, increases probability of complications. These indicators are considered independent criteria.

Conclusions

Quantitative analysis of ICG perfusion patterns using $T_{1/2MAX}$ and TR can be applied to detect segments with poor perfusion, thereby reducing anastomotic complications during laparoscopic colorectal surgery.

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