

# Safe Intestinal Anastomosis in Colorectal Surgery

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Colorectal surgery is one of the important sub-specialty of surgical and allied field. Intestinal anastomosis is a routine procedure performed for many surgical conditions. However, anastomotic leak is the most feared complication that results in increased morbidity and mortality. The leak rate ranges from 1-30%, with most of the patients requiring surgical revision with prolonged hospital stay and cost of treatment.<sup>1,2</sup> The mortality in such cases is reported as 6-22%.<sup>2,3</sup> In oncologic cases outcome is even dismal. Many factors are considered responsible like surgical technique, use of suture material or devices as well as patient related conditions.

The most important surgical step for optimal outcome is good perfusion of bowel segments to be anastomosed. Poor local tissue oxygenation due to inadequate perfusion causes anastomotic leaks.<sup>3,4</sup> Conventionally in open surgery, surgeons used to perform peroperative bowel perfusion evaluation by noting color of bowel wall, peristalsis, temperature, bleeding from edges and pulsation of mesenteric arteries. However, in minimal access surgery the color appreciation is difficult and palpation of pulsation is not possible.

The laparoscopic colorectal resection has produced similar outcome as that of open surgery in terms of complete removal of lesion with safe margins, and long-term oncologic outcomes. However, technically it is demanding and still not considered as the gold standard.<sup>5,6</sup> The difficulties are attributed to the small anatomical space of lower pelvis, use of rigid instruments with limited movements and the nature of the tumor itself. Robotic platforms offer advantages

in overcoming some of these technical difficulties and allow precise dissection in pelvis through motion scaling and intuitive manipulation, high-definition 3D magnified images and endowrist instruments.<sup>6</sup> Trimodal testing of bowel segment blood supply, tension on anastomosis and mechanical integrity are considered as the most important steps to prevent colorectal anastomotic leaks. Air-leak test and methylene blue test are used to check the mechanical integrity. They are simple, cost effective and safe methods for identification of leaks during the surgical procedure. Intraoperative colonoscopy can also be employed for this purpose.

Indocyanine green (ICG) is reported as an effective technique in reducing the risk of surgical revision due to leaks by approximately 60%.<sup>7</sup> ICG is one of the common fluorescent agents used in general surgery which is safe and easily available. It is a water-soluble, tricarbo-cyanine dye which absorbs near-infrared (NIR) light at 800-810 nm and emits it at 830 nm.<sup>4</sup> It is given intravenously, where it binds to plasma proteins (half-life 3-5 min) and then undergo hepatic clearance (in 15-20 min). It can also be injected into tissues, where it migrates through lymphatic vessels into lymph nodes.<sup>4</sup> Repeat injections can also be given. However, it needs special NIR imaging system that can excite and detect the fluorescence. It gives detailed anatomical information during surgery about the blood supply and lymph nodes. This helps to define the point of resection after mesenteric division as well as show the presence of ischemic area before performing the anastomosis. A re-resection can be done safely, if ICG shows any ischemic area, thus preventing potential postoperative leak.

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Surgical resection is the mainstay of the treatment for colorectal cancers. Radical resection confers the greatest chance of long-term survival. This involves the resection of primary tumor along with associated lymph nodes, the concept of total mesorectal excision (TME) and complete mesocolic excision (CME).<sup>4</sup> However, there is likely increased morbidity with such extended resection. ICG is of considerable help in dealing with this. In addition to checking the integrity of bowel segment perfusion, ICG helps in lymphatic

mapping for curative resection. Hence, a tailored, rather than radical lymphadenectomy can be done, with decreased postoperative morbidity. It also helps in identification of aberrant involved lymph nodes that can be removed. Also, ICG angiography can help in highly selective diversion of anastomosis after total mesorectal excision for rectal carcinoma, either by laparoscopic or transanal total mesorectal excision. Further, intrauretral ICG can be employed to prevent iatrogenic ureteral injury during colorectal surgery.<sup>4</sup>

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