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REGENERATION OF LARGE INTESTINE COLON AFTER SUTURING IT BY DIFFERENT WAYS

The operation on large intestine is one of the frequently occurred cases in surgery. This paper will concern which types of large intestine sutures and their regeneration. Both absorbable and non-absorbable sutures may be used for closure of the colon. We read several clinical trials, interpreted their results.

Keywords: *large intestine, suture, anastomosis, regeneration*

Introduction: Colon is the organ where suture regeneration occurs fast. It is healed at a rate similar to that of the stomach and small intestine. A high rate of collagen synthesis is maintained for a prolonged period (over 120 days). The entire gastrointestinal tract exhibits a loss of collagen and increased collagenous activity immediately following colon anastomosis. So, in order to increase the chance, rate and grade of healing the suture implications must be provided. Hence, the quality of healing will depend on: way of knot placement, whether the suture is interrupted, intestinal layers involved, suture tension, suture materials, folding of the anastomosis (inverting or everting) number of rows and methods of suture implication itself. According to these parameters and after their comparison, we will learn what kind of suture will bring more benefit in different operations.

Methods and materials: A systematic search of the electronic databases EMBASE, PubMed, Google Scholar and Cochrane Central Register of Controlled Trials, was conducted in September 2018 using the key words: "large intestine", "anastomosis". Then we filtered the necessary articles by choosing the next criteria: clinical trial, last 5 years, full text. Reference lists of relevant studies were searched manually. Our review did not have a registered protocol but followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. Titles and abstracts of articles were scanned independently by three researchers to identify articles to retrieve in full. The study design is experimental, that was conducted on humans', dogs' and mice' colons.

Results and discussion:

Influence of the distance between interrupted sutures and the tension of sutures on the healing of experimental colonic anastomoses. The experiment conducted with usage of 2 groups of mice and two different suture technics were applied in anastomosing the ends of the colon. In group I the anastomoses were constructed of a single layer of continuous inverting suture. In group II the anastomoses were made of one layer of interrupted inverting sutures. In both groups 7-0 polypropylene was used as suture material with the stitches approximately 2 mm apart. Eight to ten stitches were used in each anastomosis. Complications in Animals with Colonic Anastomoses: in group I (continuous suture) there were twenty-eight complications (27%) that could be featured to defective anastomotic regeneration. 4 animals died. Anastomotic hiatuses and per anastomotic abscess are observed in 15 animals. In 9 other animals' considerable colonic dilatation was observed. In group II (interrupted suture) 3 anastomotic hiatuses (5%) are observed. So, we can see very big discrepancy within these two groups on subject of complication frequency. The discoveries demonstrate that the intruded on suture method is ideal for anastomosis in the colon.^[1]

In another research, there were randomized study on adult elective patients. The primary endpoint was the frequency of clinical anastomotic leakage up to 3 months after surgery. Estimated the sample size was 768 randomized patients. The main secondary endpoints were the duration of the anastomotic suture, postoperative morbidity and stool samples after 3 months of follow-up. This study did not reach sufficient power and cannot confirm whether both techniques might be equally superior. Exploratory analysis suggests that in elective colonic resections, the single-layer continuous hand suture technique may be equally effective as the double-layer technique regarding incidence of anastomotic leakage, length of hospital stay, overall postoperative complications, subjective short-term wellbeing and stool patterns.^[2]

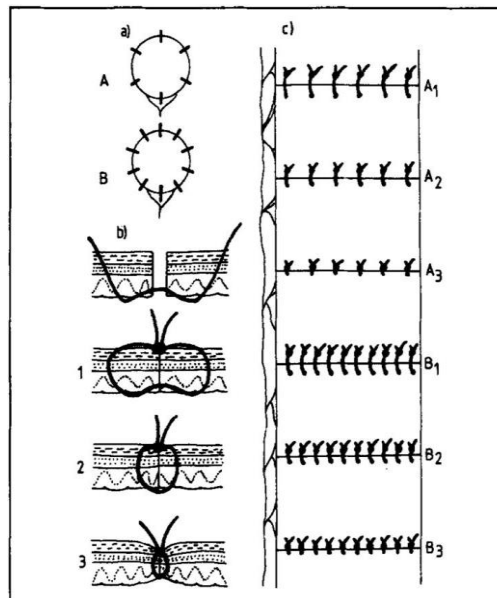


Figure 1. Suture model: (a) Long distance between sutures in group A was created by 6 sutures and short distance in group B by 10 sutures; (b) Three suture tensions were produced by means of a spring balance: (1) no tension, (2) moderate tension, (3) high tension; and (c) Combination of distance between the sutures and suture tension resulted in 6 techniques.

A metal rod measuring 2 cm in length and 0.5 cm in diameter was put into the colon lumen and later removed before tying the last stitches. Longitudinal lines on the rod, visible through the colon wall, marked the position of 6 stitches (long distance: group A, 2.5 mm) or 10 stitches (short distance: group B, 1.5 mm), and a circular scale allowed to take a bite of exactly 2 mm from the wound edge of both margins for the Gambee-stitch. Thus, each stitch contained the same amount of tissue, which is a basic condition for the standardization of the suture tension. The stitch without tension leveled off the wound edges without crushing the tissue (tension 1). Moderate (tension 2) and high tension (tension 3) were created by pulling the knots with a spring balance at 0.2 N and 1 N, respectively.

The result shows us that tensionless sutures hadn't caused any changes in vessels. In case of moderate suture tension, the blood vessel was shifted, but stayed intact. Avascular zone around the wound edges is observed in high tension knot. Avascular areas of elliptical shape were seen between the wound edges. They could be detected in all anastomoses in groups A1, A2, and A3 on day 2, similar to the mucosal dehiscence visible by gross appearance from the mucosal side. Later, hypervascularization developed along the wound edge with multiple new vessels crossing the anastomosis. On day 14 and more distinctly on day 21, vessel architecture was regenerated in group B2 and was sometimes difficult to distinguish from the normal bowel wall. Areas of sutures with high tension remained hypovascular. The results demonstrate the influence of suture technique on the wound healing of intestinal anastomoses. The best healing pattern was achieved by a small distance between the sutures and a moderate suture tension.^[3]

Absorbable suture materials that are commonly used for intestinal anastomosis include the following:

- a. Polyglactin
- b. Polyglycolic acid
- c. Chromic catgut

The materials from polyglactin and polyglycolic acid cause less inflammation than those of chromic catgut. Silk is the most regularly utilized nonabsorbable suture, however it starts an exceptional fiery response. More up to date engineered nonabsorbable sutures (e.g., polypropylene) evoke less provocative response. For the most part, in two-layer anastomoses, absorbable sutures of polyglycolic corrosive or polyglactin are utilized, with an external seromuscular fasten of silk. In one-layer anastomoses, a nonabsorbable suture, for example, silk is favored.^[7]

Intestinal anastomosis is generally performed in two layers. The inadequacy of the two-layer strategy is that it is to some degree dull and tedious to perform. However, different studies like meta-analysis and randomized controlled trials shows us that there wasn't any leakages or other incidental complications in anastomoses using the single-layered technique. The more the number of rows, the higher the guarantee that microorganisms will not pass the lumen of colon through suture or ligature canal. Its caused by worsening of the perfusion of organ and excess tissue compression. Besides, absorbency may play certain role in this process. However, this type of suture implication may lead to suture failure, that is not good for tissue that hasn't yet regenerated. In this case restrained one-rowed suture will be more beneficial than weak 2-3-rowed ones. Nowadays, in surgical practice the preference is given to dissolvable single-row sero-muscular-submucosal suture. Pros of the single-row

sutures: 1) work speed; 2) decreased traumatization; 3) lesser amount of foreign tissue; 4) better intestinal wall layers cohesion; 5) smaller tissue adhesion area; 6) lesser degree of lumen distortion; 7) lesser degree of blood and lymph circulation compromise; 8) faster tissue regeneration; 9) faster and better scar formation; 10) lesser degree of tissue infiltration; 11) lesser chance of micro abscess formation; 12) faster immune suture rejection. Knots inside the lumen are easily can be rejected and eliminated via GIT. However, using the unabsorbing suture material, the posture of knot has no matter.^[6]

The healing of single- and double-row stapled circular anastomoses. This research's aim is to learn if the single- or double-rowed staple anastomoses will lead to more strong healing, avoiding clinical incidences (necrosis etc.) causing adverse influence on wound healing. So, the results show us the following: the yearly healing was occurred in single-rowed stapled anastomosis, while the double-rowed one has a high level of necrotized tissue, probably, because of overlapping clamps of staples. The situation in serosal coat is nearly equal as in single-, as in double-rowed sutures. Some differences occurred at the beginning of the healing, due to better contact of layers in double-rowed sutures. But in 48 hours the situation has become equal. Although, the later circumstances have shown us the better hermetic feature in double-rowed one's, but it doesn't matter, because the strength of single-rowed is also on proper level. So, for fast and emergence healing the 2 rowed suture stapling must be chosen, knowing that tissue damage will be more than in 1-rowed one's, while the later will bring you more accurate scar with less tissue damage.^[5]

Inverting vs everting anastomosis.

Also one of the types of suture implication: inverting – serosa to serosa application, everting – mucosa to mucosa. There were lots of researches comparing colonic anastomosis healing by these ways. Experiments were provided on dogs. To pros of everting anastomosis are referred wider lumen space, hence no further stenosis will be, less anastomotic edemas and, the tensile strength is much higher, than that of in inverting anastomosis, again, because of absence of anastomotic edemas. Everting anastomosis cause, mainly, local incidents, which probably prevent the clinical implementation. On the other hand, the inverting anastomosis is more resistant to disruption, although causing greater stenosis. But leakage rate is higher in everting anastomosis, than in inverting one, and marker organisms are found mostly also in everting anastomosis. Hence, peritonitis is more frequently occurred in everting anastomosis. So, despite the pros of everting anastomosis, the inverting one has more reliability and more ability to tolerate conditions of stress.^{[8][9][10][11]}

Conclusion: After observing several articles, there is an inference that researches have shown different results. These results depend on severity of trauma of colon, and it plays a major role on choosing the type of material, number of rows, tightness, distance and type of suture. So, mainly these factors will have great impact on colon healing, but further researches may show us even more accurate measures.

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ТОҚ ІШЕКТИҢ ТҮРЛІ ТІГІС ЖОЛДАРЫНАН КЕЙІНГІ РЕГЕНЕРАЦИЯСЫ

Түйін: Тоқ ішекке жасалатын операция хирургиядағы ең көп таралған жағдайлардың бірі болып табылады. Тігістен кейінгі жедел жазылуға бейім мүшелердің бірі тоқ ішек, асқазан және өт қабы. Бұл мақала тоқ ішектің тігіс түрлері және оның регенерациясын қарастырады. Тік ішек, тоқ ішек және асқазанның жазылу уақыты бір. Коллаген синтезінің жоғарғы деңгейі 120 күнге дейін созылады.

Барлық асқазан-ішек жолдары коллаген деңгейінің төмендеуін көрсетеді және тоқ ішек анастомозынан кейін бірден коллаген белсенділігін жоғарылатады. Сіңірілетін және сіңірілмейтін тігістер тоқ ішектің тігілуі үшін қолданыла алады.

Түйінді сөздері: тоқ ішек, тігіс, анастомоз, регенерация.

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РЕГЕНЕРАЦИЯ ТОЛСТОЙ КИШКИ ПОСЛЕ НАЛОЖЕНИЯ ШВОВ РАЗЛИЧНЫМИ СПОСОБАМИ

Резюме: Операция на толстую кишку является одной из часто проводимых в хирургии. Наряду с желудком и желчным пузырем, шов, наложенный на толстую кишку, является одним из быстро заживающих. В этой статье будут затронуты типы швов, накладываемых на толстый кишечник, и уровень их регенерации. Толстый кишечник заживает так же быстро, как и желудок и тонкая кишка. Высокий уровень коллагена поддерживается в течение длительного периода (>120 дней). Весь желудочно-кишечный тракт обнаруживает потерю коллагена и повышает коллагеновую активность сразу после наложения анастомоза на толстую кишку. Следовательно, для наложения шва на толстый кишечник могут быть использованы как рассасывающиеся, так и не рассасывающиеся швы.

Ключевые слова: толстая кишка, шов, анастомоз, регенерация