ETHIOPIAN INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

eISSN: 2349-5715 pISSN: 2349-5707

Volume: 10, Issue 12, Dec-2023 SJIF 2019: 4.702 2020: 4.737 2021: 5.071 2022: 4.919 2023: 6.980

CHARACTERISTICS OF MODERN SUTURE MATERIALS FOR PREVENTION AFTER SURGICAL COMPLICATIONS

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Abstract: Tissue joining is one of the most difficult stages of surgery, the quality of which largely determines the outcome of the operation. Numerous publications describing various methods for comparing tissues only confirm the complexity and unsolved nature of this problem. The article provides a review of the literature on the problem of using suture surgical material.

Keywords:traditional suture material, modern suture material, modified suture material, method, classification of suture material.

INTRODUCTION: Today, there are several options for joining tissues (surgical suture, hardware suture, adhesive connection, laser welding of tissues). Each of them is equally characterized by certain disadvantages and advantages [5]. The most common currently is the connection of tissues through a surgical suture [1].

MATERIALS AND METHODS: Nowadays, the list of properties that an "ideal" suture material should have has been significantly expanded. Based on data from various authors [1, 6, 7, 8, 15, 23, 24], it is possible to determine the requirements for surgical threads: bioinertness, atraumaticity, the strength of the thread must exceed the strength of the wound at all stages of its healing, the reliability of the knot and tensile strength in the knot, resistance to infection, programmable absorbability (after performing its function, the suture material must be absorbed as soon as possible), good handling qualities, applicability for any operations, lack of wicking, carcinogenicity and allergenicity properties, lack of ferromagnetic properties, low price, ease of sterilization [3].

RESULTS AND DISCUSSION

Classification of surgical suture material

There are numerous classifications of suture material, which are based on various qualification characteristics (by origin, by structure, by purpose, etc.), therefore they are one-sided in nature and do not cover the entire complex of physical, biological and functional properties inherent in suture surgical threads [3].

Classification of suture material according to V.M. Buyanov

Absorbable materials include:

• catgut, collagen;
• silk;
• materials based on polyamides (ka-
pron);
• cellulose-based materials (approx.
celon, cacelon);
• materials based on polyglycolides
(biosin, vicryl, dexon, maxon);
• materials based on polydioxanone (polydioxanone);
• materials based on polyurethanes
(polyurethane).

Non-absorbable materials include:

• materials based on polyesters (lavsan, mersilene, etibond);
• materials based on polyolefins
(surgipro, prolene, polypropylene);

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- materials based on polyvinylidene (Koralen);
- materials based on fluoropolymers (Gore-Tex, Vitafon);
- metal-based materials (metal wire, brackets).

Characteristics of the properties of traditional suture material

Traditional suture materials include surgical threads made of catgut, silk, cotton, nylon, lavsan, which historically have been used and continue to be used in clinical practice for suturing damaged tissues of humans and animals.

Threads based on materials of plant origin. Silk and cotton are conditionally absorbable materials of natural origin. A silk thread loses most of its strength in the human body within 3–6 months, and complete resorption is usually completed by 2 years after implantation. Cotton is a non-absorbable suture material, which means that it retains most of its strength for more than 6 months. Otherwise, silk and cotton are similar. Based on their physical and mechanical properties, they are considered the "gold standard" in surgery. Surgical threads made of silk and cotton are soft, flexible, durable, allow you to knit two knots, and are easy to sterilize. At the same time, this type of suture material is easily infected, becomes unfibered, and causes aseptic inflammation up to the formation of necrosis. When using silk thread in the experiment, 10 microbial bodies of staphylococcus were enough to cause suppuration of the wound [5].

Threads made on the basis of synthetic polyamide compounds (nylon threads). Polyamide is produced in two types - monofilament and polyfilament thread. Nylon ligatures (polyamide-6) have good initial strength (2 times stronger than catgut and 12.5 times stronger than silk), elasticity, resistance to deformation and abrasion, and a high elongation at break (22%) [1, 3]. Under the influence of the body's environment, polyamide suture implants are subject to destruction, depending on the type of fiber (nylon, nylon, silone, perlon), the metabolic characteristics of the body (rat, dog, rabbit, human), and the type of tissue into which the implantation was performed (skin, muscles, liver, gastrointestinal tract), loss of strength occurs at different rates. In the rat body, the loss of strength occurred as follows: 15–20% of strength was lost during the first 2 weeks, about 40% during the first month, and after three months only 28% of the original value remained [5]. According to other data, after a year of implantation of polyamide threads, their strength was about 50% of the original. A significant disadvantage of polyamide is its high hydrophilicity: at a temperature of 20°C and a relative humidity of 60%, moisture absorption by nylon is 4.5%; in an aqueous environment, polyamide absorbs another 12% of moisture from its own weight, while its strength decreases by 11–18%.

Methods for modifying traditional surgical sutures

The idea of modifying the suture material belongs to Ab Aquapendente from Padua (1537–1619), who proposed the use of "flax impregnated with gum." In 1869, Lister proposed coating it with chromium to make catgut more rigid. Subsequently, the modification of suture material in order to impart new properties to it became widespread, and today a significant number of surgical threads have various types of coatings applied to their surface. Polyfilament threads are predominantly modified to improve biological properties and eliminate the "sawing effect".

Characteristics of the properties of modern suture material

Modern suture material intended for suturing tissues is represented by surgical threads, which are made of synthetic polymeric materials that have the physical and biological properties inherent in high-quality suture material. These include Dexon, Vicryl, Maxon, PDS, Nurolone, Etibond, Prolene.

In relation to biodestruction by body tissues, modern suture material is divided into absorbable and non-absorbable synthetic threads, according to its structure - into multifilament (Dexon, Etibond, Nurolon, Polysorb) and monofilament (Maxon, PDS, Prolene).

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Modern synthetic suture material is used, as a rule, in specialized branches of surgery (vascular surgery, cardiac surgery, neurosurgery, ophthalmology) that require precision suture technique.

The purchase volume is 10% of the total quantity of purchased suture material.

CONCLUSION

1. Scientific research into various types of suture material and its relationship with body tissues is timely and relevant.

2. Existing modern traditional surgical threads do not meet the requirements of an “ideal” suture material and need to be improved in physical and biological properties.

3. Improved surgical sutures can be obtained by developing a new synthetic material or by modifying traditional surgical sutures.

4. Modification of surgical threads by applying a bioinert polymer coating to their surface makes it possible to significantly modify the basic properties of the suture material, bringing it closer to modern surgical threads.

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