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Review on Medical Textiles:Antimicrobial Sutures

K.Gomathi [1], E.Devaki[2], A.Lakshika[3], B.Senthil Kumar [4]
1,3 Research Scholar, 2 Associate Professor
Department of Costume Design and Fashion,PSG College of Arts &Science, Coimbatore
4 Assistant Professor, Department of Rural Industries Management, The Gandhigram Rural Institute,Gandhigram

Abstract

The most often used medical instrument for wound closure in healthcare is probably surgical sutures. Sutures may come into contact with microorganisms during application. Environment that promotes the development of bacterial bio films and, ultimately, surgical site infections. The physicochemical properties of the polymeric substrate significantly influence how the suture behaves in a biological environment. In such a situation, it is essential to create sutures that actively discourage bacterial colonisation and adherence to their surfaces. Sutures that release drugs have been suggested as an answer to this problem. In order to create antimicrobial surgical materials, bioactive compounds (natural or synthetic) are now being introduced into polymeric materials using a variety of techniques, including blending and compounding, surface fictionalization and conjugation, and coating.

Key words: medical textiles,sutures,antimicrobial activity

Introduction

Sutures are used to repair topical and sub-dermal wounds following surgery, injury, harm, or mutilation. They are an integral component of wound healing. The optimal suture should be flexible, biodegradable, antibacterial, and supportive of the abrasion in addition to being simple to use, sterile, and flexible. until the damaged site is stabilised by the development of new tissue. Suture structure and diameter are linked to less resistance to traction. The choice of size must strike a balance between the size of the suture and tissue approximation, resulting in adequate healing. The purpose of sutures is generally to approximate tissues, minimising tissue injury and avoiding excess tension. Surgical threads come in a variety of forms, both natural and artificial. Only silk, cotton, and linen fibres are currently obtainable commercially from natural sources. They are all, however, non-absorbable suture biomaterials.

Poor healing is still one of the most common post-operative consequences, and wound infections are still common kinds of nosocomial infections. Surgery site infections (SSIs) are the third most prevalent hospital acquired infections despite extensive systemic antibiotic prophylaxis. When a surgical wound is contaminated with at least 106 bacteria per gram of tissue, there is a danger of infection; this risk escalates when foreign items (such as sutures, permanent devices, or prosthesis) are inserted By the time they are healed, surgical wounds are all polluted and associated with various risk factors Inadequate wound cleaning and contamination prior to surgical closure are the main causes of surgical site infection. To combat bacteria that are resistant to antibiotics, antimicrobial sutures continue to play a crucial role in preventing surgical site infections. The surgical suture's substance contributes to bacterial adhesion and biofilm formation on its surface, and it develops resistance to common antimicrobial medications. As a result, there are other options to decrease bacterial adhesion on suture material, such as coating it with an antibacterial substance.

Sutures

Sutures have been used for thousands of years, there are now a growing number of different types available. Suture materials have undergone significant refinement; they are now even knotless and antibiotic-coated. Numerous aspects must be taken into account while choosing the best suture, including the patient's age, the location of the wound, the specifics of the wound, the presence or absence of infection, and the surgeon's personal preferences and prior experience with the suture material.

Suture structure

The main characteristics and traits that affect how well different sutures perform are the filament structure, size, degrading property, tensile strength, surface texture, stiffness, and flexibility of the materials . Sutures' capacity for tissue repair and their resistance to tissue-induced stress are closely correlated with their size and tensile properties. For a better healing process, the tensile strength of the tissue and the suture material should be balanced. The amount of weight (kg) required to sever the suture material is a known indicator of the tensile strength of suture materials, which varies with its size.9Additionally, the number of filaments (monofilament or multifilament) determines the suture material's tensile strength.

Types of sutures

Absorbable Sutures

In order to maintain the wound until it has healed sufficiently to tolerate normal force, absorbable sutures are used. Enzymatic breakdown and hydrolysis are how materials are absorbed when they are natural or manufactured, respectively. In comparison to enzymatic breakdown, hydrolysis generates less tissue response. The duration of the first stage of absorption, which has a linear rate, is a few days to a few weeks. Loss of suture mass and overlap with the first stage characterise the second stage. Leukocytic cellular reactions that clear cellular waste and suture material from the line of tissue approximation cause the loss of suture mass. Examples: Catgut, Chromic, Vicryl, PDS

Non absorbable suture

Non-absorbable sutures are intended to either be left in the body permanently or to be removed following a predetermined healing period. Non-absorbable, permanently implanted sutures are typically utilised in tissue where, even after healing, the new tissue might never be strong enough to sustain itself. Such sutures maintain a high effective tensile strength throughout time. Non-absorbable sutures that are used to seal skin are typically removed after 10 to 14 days, though this can vary depending on the location and circumstance. Sutures are used to close skin wounds, where they can be removed within a few weeks, or in some inner tissues where absorbable sutures are sufficient. Sutures are produced from materials that are not metabolised by the body. This is used in the heart and blood arteries because of their rhythmic movement, which necessitates a suture that remains in place for more than three weeks. Other organs, such as the bladder, have fluids that cause absorbable sutures to fall out too soon for the incision to heal. Removable sutures would offer a technique to lessen scarring as the foreign protein in absorbable sutures might promote inflammation that amplifies scarring. Examples include silk, Prolene, and nylon .

SSI-Related Microorganisms

The main causes of SSI are contaminated wounds and inadequate cleaning before surgical closure. Environmental pollutants or local microflora are frequently linked to the start of SSIs. Escherichia coli, Pseudomonas aeruginosa, Acinetobacter species, Staphylococcus aureus, Staphylococcus epidermidis, Acinetobacter species, and Enterococcus species are typical organisms isolated from patients with SSI. S. aureus, which is present on the skin or anterior nares of almost 80% healthy individuals, represents the most predominant organism in causing SS

SSI Risk Factors

There are numerous procedures and patients-related risk factors that might initiate and advance SSI. The nature of the surgical intervention, as well as the surgical site, wound microbial contamination levels, and the standard of pre- and postoperative care, are all procedure-related risk factors. For instance, due to a larger bacterial load at the surgical site and a higher likelihood of developing intraoperative contaminations, colon, gastrointestinal, and urinary tract procedures are linked to a significant risk of SSI.

Antimicrobial sutures

Plant extracts and other natural compounds have been identified as viable sources for antibacterial coatings for sutures. Different natural products.The potential for coating sutures with substances including grapefruit seed extract, aloe vera, chitosan, turmeric, clove oil, and eugenol has been investigated. Incorporating grapefruit seed extracts on sutures for wound healing applications has been demonstrated to be feasible . Aloe vera-based antimicrobial sutures were studied for its ability to effectively combat germs.

Conclusion

Surgical site infections continue to be a serious problem, leading to yearly increases in morbidity and mortality.Antibiotic-coated sutures, or antibacterial sutures, were created to speed up wound healing by lowering the chance of surgical site infections. According to an in vitro investigation, this suture is effective in reducing suture-related infections. Surgical site infections continue to be a serious problem, leading to yearly increases in morbidity and mortality.Antibiotic-coated sutures, or antibacterial sutures, were created to speed up wound healing by lowering the chance of surgical site infections. According to an in vitro investigation, this suture is effective in reducing suture-related infections.

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