



Review Article

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SUTURING MATERIALS IN ANCIENT INDIAN SURGERY: AN OUTLOOK IN PRESENT SURGICAL PRACTICE

Sunita R Khatri¹, U. R. Sekhar Namburi^{2*}, K. M. Chopade³, S. Y. Raut⁴, M. N Suryawanshi⁵

¹Senior Research Fellow, Ayurveda Mental Health Research Institute, Nagpur, Maharashtra, India

²Research Officer (Sc-II), Ayurveda Mental Health Research Institute, Nagpur, Maharashtra, India

³Assistant Professor, Department of Shalyatantra, Pandav Ayurveda College, Nagpur, Maharashtra, India

⁴Professor, Department of Shalyatantra, Government Ayurveda College, Nagpur, Maharashtra, India

⁵Assistant Director In-charge, Ayurveda Mental Health Research Institute, Nagpur, Maharashtra, India

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*Corresponding author

Dr. U. R. Sekhar Namburi, Research Officer (Sc-II), Ayurveda Mental Health Research Institute, Nagpur, Maharashtra, India

E-mail: shilpasekhar2k5@yahoo.com

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ABSTRACT

Suturing is the closure of surgical as well as the traumatic wound and also final step of every surgical procedure. Acharya Sushruta is the pioneer surgeon of ancient Indian surgery, has mentioned eight different surgical procedures (Ashthavidha Shastrakarma), like Chedana (Excision), Bhedana (Incision and drainage), Lekhana (Scarification), Vedhana (Aspiration), Eshana (Probing), Aharana (Extraction), Visravana (Evacuating) and Sivanakarma (Suturing) in his classical text Sushruta Samhita. Among these Sivanakarma (suturing) is of prime importance as proper suturing with specified suturing material leads to early healing of the wound and avoids scar formation which plays an important role cosmetically. In present contemporary medicine many of suturing materials are developed as per the need of surgical procedures. These suture materials vary accordingly in their absorption, tensile strength and viability. However many of these materials are synthetically processed substances and may cause tissue incompatibility. In ancient Indian surgery the suturing materials were developed depending on availability of natural resources like plant and animals and were successfully used in the various surgical procedures for closure of wound as well as for supporting to the body tissues. In present surgical practice these are not tried may be because of the poor understanding or improper analysis. However, if these suturing materials described in ancient text processed and developed with modern techniques may bring the revolution in utilizing the natural suturing materials which are more compatible to the tissues of the body and helps in quick healing of wound with minimal or negligible scar formation.

Keywords: Sivanakarma, ancient suture material, horse hair, ants head.

INTRODUCTION

The ancient Indian surgical science is known as Shalyatantra and this branch of medicine is well explained in Sushruta Samhita by Acharya Sushruta, who is the pioneer of ancient Indian surgery. He has elaborately mentioned about eight main surgical procedures under heading of Ashthavidha Shastrakarma like Chedana (Incision), Bhedana (Excision), Lekhana (Scarification), Vedhana (Aspiration), Eshana (Probing), Aharana (Extraction), Visravana (Evacuating) and Sivana (Suturing)¹. Among these Sivanakarma (surgical suture) is one of the most imperative last procedure as any surgical procedure either it may be open or laparoscopic method, along with precise suturing material is necessary for success of surgery. In ancient days of Indian surgery Acharyas were aware about the benefits of closure of the wounds. In this regard a combination of archaeological and anthropological studies offer insight into man's early surgical techniques such as suturing lacerations, amputating in salvageable limbs and draining and cauterizing open wounds. Some Asian tribes had practiced crude methods by using a mixture of saltpeter and sulfur that was placed onto wounds and lit on fire to cauterize for closure of wounds. Similarly tribes in India and South America developed an ingenious method of sealing minor injuries by applying termites or scarabs that who are around the edges of the wound and then twisted the insect's neck leaving their heads rigidly attached like staples². This indicates that in ancient days the most diverse and natural suture materials had been used for

closing and suturing the traumatic and surgical wounds. The most ancient suture materials are mentioned by Sushruta which are derived from natural resources like sukshama sutra (fine cotton threads), bark fibers of asmantak (*Ficus rumphi*), sana (Jute fibers), kshuma sutra (silk thread), fibers of murva (*Marsdenia tenacissima*) and fibers of guduchi (*Tinospora cordifolia*) bala (animal hairs) and snayu (animal tendon)³. Further some more suturing materials are explained by Acharya Vagbhata like fibers of atasi (*Linium usitaitisimum*)⁴. In the context Bhinna vrana, Acharya Sushruta has mentioned particular suturing intervention for closure of intestinal perforation in which the perforation site was bitten by the ant's heads and body of ant was separated leaving the heads attached at the place. In this way the intestinal perforations were treated⁵. In the present era a wide range of synthetic suturing materials is developed which help the body to heal by closely opposing two sides of a wound to minimize scar formation or to prevent leaking blood, like in vessels. These sutures are available in various sizes ranging from number 12-0, which is the finest, to number 5, which is the heaviest and comply with several regulations and guidelines to ensure that they meet the necessary requirements such as -

- Sterility
- Uniform diameter and size
- Pliability for ease of handling and knot security
- Uniform tensile strength by suture type and size
- Freedom from irritants or impurities that would elicit tissue reaction⁶.

In developing country like India huge population reside in rural areas and they get treated at local healthcare centers, where the availability of expensive suture materials is not possible. So, there is need to search for easily available as well as cost effective suturing materials that are free from the chemicals and can be used safely without any kind of allergic tissue reaction. However, the suturing materials derived from plant and animal sources if scientifically designed as per the requirement can be used excellently as they were used in ancient days.

Suturing materials

Suturing materials are mainly classified based on disintegration and source of the material. Depending on the disintegration these are classified as absorbable and non-absorbable, while based on the availability these are classified as natural and synthetic suture materials. Absorbable sutures are made of materials which are broken down in tissues after certain period from ten days to eight weeks depending on the material. These sutures dissolve in the body by either hydrolysis or degradation by proteolytic enzymes in the body hence removal of the sutures is not required. Therefore, they are used in the repair of many the internal tissues of the body. Presently catgut is widely used natural and vicryl is synthetic absorbable suturing material. Regarding the non-absorbable sutures which are not metabolized by the body hence used for either skin wound closure or inner tissue support like cotton thread from natural source and propylene threads from the synthetic source. Similar type of classification can be analyzed for the natural suturing materials mentioned in the ancient classical surgical texts. Among those sukshama sutra (fine cotton threads), bark fibers of *Asmantak (Ficus rumphi)*, sana (jute fibers), kshuma sutra (silk thread), fibers of murva (*Marsdenia tenacissima*), fibers of guduchi (*Tinospora cordifolia*) and fibers of atasi (*Linium usitaitisimum*) are plant originated. Similarly bala (animal hairs), snayu (animal tendon) and ant's heads are animal originated suturing materials. Further if these are evaluated accordingly absorbable and non-absorbable suturing materials, the plant source such as sukshama sutra (fine cotton threads), bark fibers of *Asmantak (Ficus rumphi)*, sana (jute fibers), kshuma sutra (silk thread), fibers of murva (*Marsdenia tenacissima*), fibers of guduchi (*Tinospora cordifolia*), fibers of atasi (*Linium usitaitisimum*) and bala (animal hairs) may be considered as non-absorbable suturing materials as these cannot be disintegrated by hydrolysis or tissue enzymes; while snayu (animal tendon) and ant's heads may be considered under absorbable suturing materials.

Suturing materials - Plant source

Method of separation of plant fibers

The fibers of above specified plants have its cell wall made of cellulose microfibrils in a net-like arrangement which gives strength. Further Sclerenchyma fibers present in plant fibers forms secondary cell wall which provides even more strength to plant fibers. These plant fibers are separated from the woody core epidermis by retting which is a process that employs water and microbial action to separate the fibers⁷. After this process non degradable fibers are only obtained. Later tensile strength of the

fibers can be determined and the fibers having adequate tensile strength can be used as surgical suture material after gaining the characteristics like sterility, uniform diameter, size and strength etc.

Suturing materials - Animal source

Suturing materials derived from animal sources can be used after the processing. Suturing with horsehair was routinely practiced in ancient India and at various places all over the world⁸. There are many references that mentioned horsehair as a civil war sutures. During war, it has been used as an emergency suture when there was shortage of other suture materials⁹. Recently use of horse hair for tendon suturing was evaluated¹⁰. Horse hair in its natural state is too stiff to make sutures. When it is boiled in water, soften and become more pliable and sterile. Horse hair has got diameter of 0.19 mm which complies with the 4-0 size USP standard, straight pull tensile strength 0.5851 ± 0.122 kg and knot pull tensile strength 0.3998 ± 0.078 kg, which complies with the standards of United State Pharmacopodia for class II non-absorbable suture materials.

CONCLUSION

In ancient days of Indian Surgery Acharyas selectively and abundantly used natural resources in preparation of suturing materials which were easily available as well as economical and many of these materials were monofilament which avoids the spreading of infection after the suturing. Acharya Sushruta is the first Indian surgeon to describe about the various suturing materials and suturing techniques in detail. In the classics of Ayurveda suturing materials were explained descriptively. If these materials are analyzed, the ancient Indian surgeons have given more importance to natural resources as these may be less tissue irritant and compatible to the body tissues. Further they were having the good understanding about the indications of the particular suture material in various surgeries like using of ant's heads for suturing intestinal perforation, which shows their knowledge regarding absorbable and non-absorbable suturing materials even though such classification is not mentioned in the classical texts. Moreover the described materials are also available quantitatively in the present era and these can be utilized if processed and prepared according to modern scientific interventions. Further a lot of pre-clinical and clinical studies are required to explore treasures of knowledge in this field of Indian surgery.

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