

Hemostasis In Oral Surgery- A Review

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ABSTRACT: -

Bleeding during and after surgical procedure in the field of oral and maxillofacial surgery, poses a great challenge to the surgeons^[1], if uncontrollable. It normally occurs from a hard or soft tissue, classifying as arterial and venous origin. Identification of source of bleed requires good illumination and visibility, which can be achieved through proper light angulation and suctioning^[3]. To restrict the copious bleeding, instruments like electrocautery and suture ligatures are utilized. Electrosurgical instruments have the disadvantage of endangering teeth or nerves, as a substitute, topical hemostatic agent. A general knowledge of how coagulation process occurs will allow the clinician, the action of hemostatic agents and exact timing of application.

Key Words: Hemostasis, hemostatic agents, bleeding, oral surgery

INTRODUCTION: -

Bleeding during and after surgery remains the most challenging task for both surgeon and the patient undergoing surgery, if it is uncontrolled. This hampers the visibility of the surgical field and light also to pass through for proper visibility of surgical field. The bleeding can be classified as arterial, venous and capillary, based on the origin. This can be sort out by knowing the proper source of bleed, proper suctioning and methods to achieve maximal hemostasis. In this article, we will discuss the detail of etiology of hemorrhage, methods and materials to achieve hemostasis.

MATERIALS AND METHODS: -

ETIOLOGY OF HEMOSTASIS: -

It involves three major steps namely, 1. Vasoconstriction 2. Formation of platelet plug 3. Coagulation^[3]. The first step involves immediate constriction of damaged or injured blood vessels. The second step involves mechanical blockage of defect by a plug that forms as platelets stick to exposed collagen. The third step involves formation of coagulation cascade. The coagulation cascade is a series of dependent reactions including plasma proteins, calcium ions, blood platelets leading to fibrin thread formation^[2]. The fibrin protein fiber mesh reinforces and stabilizes the platelet plug to form a clot. There are two important pathways to form a fibrin clot, namely intrinsic, extrinsic and common pathway.

INTRINSIC PATHWAY:-

It is initiated when contact is made between blood and exposed negatively charged surface. On contact activation, prekallikrein converted to kallikrein, leading to activation of factor 12 to 12A to 11 to 11A and in the presence of Ca^{++} factor 11A activates factor 9 to 9A, cleaving to factor 10 to 10A, initiating the common pathway^[3].

EXTRINSIC PATHWAY:-Factor 3 released from tissue instantly after the onset of injury , initiating the extrinsic pathway. The factor 3 forms a complex with factor 7A, which catalyzes the activation of factor 10 , cleaving to become factor 10A^[3].

COMMON PATHWAY:-

The intrinsic and extrinsic pathways converge at activated factor 10A, resulting in the conversion of prothrombin to thrombin. This thrombin converts fibrinogen to fibrin , which appears as a clot, being polymer in structure.

HEMOSTATIC AGENTS:-

Hemostatic agents are those , which aids in hemostasis. These agents should be effective in minimal concentrations , easily available , biocompatible, reliable and an effective one , contributing to the success of surgery in oral and maxillofacial sites. The hemostatic agents are classified as active and passive. The active agent is thrombin alone, used in patients receiving antiplatelet and anticoagulant type of medications. They are contraindicated in contaminated wounds.

There are many techniques to achieve passive hemostasis in surgery namely

Mechanical

Chemical

Thermal

Mechanical Agents:-

Direct pressure

Sutures

Staples

Ligating clips

Gauzes

Sponges

Chemical agents:-

Pharmacotherapy

Topical hemostats

Topical sealants and adhesives

BONE HEMOSTATS

ACTIVE HEMOSTATIC AGENTS:-

They have biologic activity and actively participate in coagulation pathway to form a clot^[2]. The active hemostatic agents are thrombin and other agents , which contains thrombin and those

product combinewith passive agent to form an active product. It is used with gelatin foam to increase the utility and effectiveness of final product.They are involved with final hemostatic steps , bypassing the initial steps , other aspects can be dysfunctional without significantly impairing the local hemostatic efficiency.

FLOSEAL [flowable hemostatic agent]:-

It is a combination of two independent agents and consists of bovine derived gelatin granules coated in human derived thrombin that works in combination to form a stable clot^[3]. When applied to the bleeding site, it will swell about 10-20%. It is resorbed by the body not more than 6-8 weeks, consistent with normal wound healing. It is used as a first line hemostatic agent, when conventional methods fail to achieve hemostasis. Therefore, it has disadvantages of transmitting infections and contraindicated in patients allergic in receiving materials of bovine origin. Adverse reactions are anemia, arrhythmia, atrial fibrillation, atelectasis, fever and right heart failure.

PASSIVE HEMOSTATIC AGENTS:-

They include collagen, cellulose and gelatin. Their mechanism of action being , formation of physical structure around which platelets aggregate to form a clot. They are available in many forms and the method of application is important in determining their efficacy. Gauze, sheets, sponges are most commonly used by surgeons. They are also available in methods of delivery like mechanical, thermal, chemical and topical agents respectively.

MECHANICAL AGENTS:-

This mode is the best to achieve hemostasis , especially using direct pressure over the injured surface, will minimize or arrest the bleeding. Followed by placing sutures over the injured surface, will contract the wound and minimize the bleeding in the injured area. Others are skin staples, ligating clips, gauzes and sponges.

CHEMICAL AGENTS:-

MICROFIBRILLAR COLLAGEN [AVITENE]:-

It is derived from purified bovine dermal collagen which is fibrous , water insoluble partial hydrochloric salt. Available as loose fibrous form and also as sheets or sponges and as topical powder form^[4]. It attracts the platelets and aids in hemostasis forming a platelet plug. They are stored in roomtemperature and easily available , but should not be resterilized^[1].

Its adverse effects include allergic reaction, adhesion formation, inflammation, foreign body reaction and potentiation of wound infections and abscess formation.

Its use is contraindicated to persons who are allergic to materials of bovine origin and in vital structures , leading to rapid absorption.

It is less commonly useful for oral surgical procedures.

ABSORBABLE COLLAGEN SPONGE [HELISTAT]:-

It is a collagen derived from purified and lyophilized bovine flexor tendon available as soft, white, pliable, non-friable , sponge like structure^[1]. They are highly absorbent predominantly being fluid weight many folds. To achieve better results, it should be kept in place for 2-5 minutes, then later

removed or replaced or left in situ. It provides 3 dimensional matrix for a firm blood clot. It should be handled dry and excess should be removed. The collagen materials have a lifespan of 14-56 days^[3], beyond that , leads to resorption. It is indicated in wound protection and control of oozing or bleeding from clean oral wounds. Likewise, it is contraindicated in areas of contaminated wounds and people who are allergic or sensitive to bovine origin materials. They serve as a nidus for abscess formation and aggravate bacterial growth. Adverse reactions are formation of adhesions, allergic reactions, subgaleal seroma formation^[3].

CELLULOSE- BASED PRODUCTS [SURGICEL]:-

Oxidized regenerated cellulose , otherwise called as Surgicel, derived from plant based alpha cellulose available in an absorbable white knitted form which is supplied in single or multiple sheets in high or low density. It is prepared as fibrin meshwork and is expensive and sterile^[3]. Hemostasis is achieved in 4-8 weeks. It has acidic properties due to its reduced pH , leading to swelling and necrosis. When thrombin combines with this, the former is ineffective due to its reduced pH and is bacteriostatic in action. It is used in 1. Closed spaces due to swelling 2. Bony defects 3. Control bleeding from large arteries. Adverse reactions include 1. Encapsulation of fluid and foreign body reaction 2. Stenosis of vascular structures 3. Surgical granulomas 4. Neurological complications.

GELATIN BASED PRODUCTS:-

Gelfoam is commonly employed hemostatic agent , which is porous. Available as films, sponges, or powder which is mixed to form a paste. It absorbs about 40 times and expands 200 % of its original volume^[3]. It induces better clot than collagen based hemostats. Adverse reactions include abscess formation, encapsulation of fluid, hematoma and localized infection and is devoid of absorption.

POLYSACCHARIDE HEMOSPHERES:-

It is a new type of hemostatic agent obtained from vegetable starch. They are used to control arterial, capillary and venous bleeding producing a water attractive action by dehydrating the blood and concentrating its solid components and increasing barrier formation. They have no intrinsic activity but stimulates clot formation by forming a scaffold , for clot organization.

TOPICAL HEMOSTATS:-

There are number of factors to consider while choosing a topical hemostatic agent. The selection depends upon the source and magnitude of bleeding and local anatomy of patient^[2].

IDEAL REQUISITES OF A TOPICAL HEMOSTATS:-

It should be rapid and effective in controlling the bleeding

It should have effective contact with bleeding surface

Reliable and easy to handle

Simple to prepare

Active and compatible with patients own physiology

Active topical hemostatic agents have shown to achieve hemostasis rapidly, provide ease of use, decrease the number of blood transfusions.

ACTIVE TOPICAL HEMOSTATIC AGENTS:-

They conserve the blood volume, reducing the blood loss. The active topical agent acts at the end of clotting cascade, less susceptible to coagulopathies caused by clotting factor deficiencies. It is ineffective in patients having afibrinogenemia^[2], affecting 1 in 1 million people. It provides hemostasis within 10 minutes since from the time of administration in majority of patients. Hemostasis in collagen-thrombin combination is three times active than collagen sponge alone. The sprayable form of thrombin offers better benefits, because wide surfaces can be treated instantly without usage of tamponade. The concentration of thrombin solution also can be varied according to severity and type of bleeding^[6].

PASSIVE TOPICAL HEMOSTATIC AGENTS:-

They offer blood conservation , by reducing the amount of blood loss. They form lattice like structure^[2] , adhering to the bleeding site, providing the platform for platelet aggregation while reinforcing the blood clot. They are useful in areas of huge bleeding due to their larger absorption capacity. They can absorb several times than that of original fluid weight. The passive topical hemostatic agents which hasn't participated in hemostasis, will absorb the moisture and expand. Any residual product present in the site will lead to infection and foreign body reaction and also granuloma.

BONE HEMOSTATS:-

BONE WAX:-

It is a sterile mixture of water insoluble beeswax, paraffin and isopropyl palmitate packaged in individual foil envelopes and used when bleeding is from bone , called as bone bleeder^[3]. It is pliable enough to be placed within vascular channel to achieve hemostasis. It is insoluble and non-resorbable. Care must be taken in sites, where bone regeneration is expected. It shows an increase in inflammation, causing foreign body giant cell reaction at the site of application due to water insolubility and longevity^[5].

OSTENE:-

It is a bone wax like preparation of water soluble alkylene oxide copolymers. It is a synthetic bone hemostatic material first utilized in cranial and spinal surgeries. It is eliminated unchanged in 48 hours. It interferes in bony union. Expensive than bone wax^[3,4].

CONCLUSION:-

Hemostatic agents should be used according to the site and size of bleeding. It should be used minimally as possible. Mechanical methods of hemostasis is the preferred first to achieve hemostasis. If uncontrollable , other agents like chemical or bone wax can be used. Selection of a proper hemostatic agent is an important part in achieving hemostasis. This depends upon the experience and preference of the surgeon.

Ethical clearance – Not required since it is a review article

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