Surgical Skills for Nurses

Mini Series

Session Two: Suturing: Why, When and How?

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Introduction

We see a large variety in the type of wounds our patients present with in veterinary practice. For example lacerations, burns (thermal, caustic or electrical), puncture wounds, bite wounds, firearm injuries, shearing injuries and de-gloving wounds. No one method can be applied to the management of all of these wounds. This presentation will concentrate on the closure of wounds by suturing; so we first need to consider which wounds are suitable for surgical closure, at what point should we close them, and then how we will close them.

Wound Classification and Assessment

Other than by referring to the aetiology of the wound, it is common to describe wounds by their level of contamination with bacteria and foreign material. Wounds are classified as: Clean; Clean-Contaminated; contaminated; or Dirty/Infected.

CLEAN WOUNDS; These are made under sterile conditions, an operative wound in which no inflammation is encountered, and there is no entry of the gastrointestinal, respiratory, or genitourinary systems. There must be no breaks in sterile technique. These wounds are closed primarily and if necessary drained with closed drainage. Examples: Splenectomy, ovariohysterectomy.

CLEAN-CONTAMINATED WOUNDS; These are operative wounds made under sterile conditions, during which the gastrointestinal, respiratory or genitourinary system is entered. There is minimal contamination which is easily removed or reduced to insignificant levels. Traumatic wounds are NEVER clean-contaminated, but may be converted to a clean-contaminated state through debridement and lavage. Examples: Bladder surgery, enterotomy, gastrotomy, elective caesarean section

CONTAMINATED WOUNDS; Open, fresh, accidental wounds or surgical wounds with major break in aseptic technique- e.g. spillage of gastrointestinal contents. There is heavy contamination and often foreign material in the wound. Examples: Rectal surgery, acutely presented traumatic wounds.

DIRTY or INFECTED WOUNDS; These are old traumatic wounds with active infection, or involving a punctured viscus. Examples: Septic peritonitis, intra-peritoneal abscess.

By studying these definitions, it is obvious that ALL traumatic wounds are either contaminated or dirty. As ONLY clean or clean-contaminated wounds should be closed, then all traumatic wounds will need lavage, debridement and management prior to considering closure.

The other important consideration of any wound is the degree of wound ischaemia. A wound with devitalised tissue present will require smaller numbers of bacteria to establish a wound infection. Consider also vascular damage to deeper structures. Crushing injuries and puncture wounds (or a combination of the two, i.e. bite wounds) can cause vascular damage beyond the grossly visible margins of a wound.

Wound Infection Rates

Postoperative wound infections have been documented in 5 % of ALL small animal surgeries. In 'clean' procedures a rate of 2.5% has been recorded, rising to 10% in 'dirty' wounds where the bacteria causing the postoperative infection are already established.

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Normally host neutrophils and the macrophages will phagocytose bacteria and prevent infection. But, if bacteria numbers exceed a critical level, then infection will occur- this critical level is different for EACH INDIVIDUAL WOUND, and depends on;

1) Host Factors- Infection id more likely if the animal is immunocompromised from pre-existing disease (diabetes, Cushings, neoplasia) or medication.
2) Local Factors- Wound conditions that prevent the action of phagocytosis promote infections; haematomas and seromas, braided suture material and drains, all provide environments where bacteria can thrive 'out of reach'
3) Bacterial Factors-Some bacteria with endotoxins, such as E Coli, cause cell damage and prevent phagocytosis.

Wound Closure Options

Skin wounds can be dealt with via:

1) Primary Closure,

2) Delayed Primary Closure

3) Secondary Closure

4) Second Intention Healing

Primary Closure- only performed on clean wounds, or clean-contaminated wounds with little ischaemic damage to tissues. Immediate closure is performed, without tension. In practice this means the closure of clean surgical incisions made under aseptic conditions, or the closure of clean-contaminated lacerations following lavage and debridement. There is only a small risk of infection and normal healing is expected.

Delayed Primary Closure- carried out 3-5 days after the wound was inflicted. This allows a period of open wound management to eliminate contamination and devitalised tissue with lavage and repeated debridement. Suitable wounds are clean-contaminated or contaminated, or wounds with areas of questionable tissue viability. The closure is carried out before any granulation tissue forms.

Secondary Closure- carried out on contaminated or dirty wounds, 5-7 days after the wound is inflicted. This extended time frame allows management of an infected wound or the removal of foreign material and devitalised tissue. The wound is managed with dressings, and then closed after the appearance of granulation tissue.

Second Intention Healing-wounds that are unsuitable for closure, or have extensive contamination and devitalisation can be allowed to heal by granulation, wound contraction and epithelialisation, without surgery. Disadvantages can include prolonged healing times, poor cosmetic results, and restriction of joint movement due to wound contraction.

Timing of Wound Closure

As can be seen from the above, when considering when to close a wound, the most important consideration is the presence of contamination and the presence of any necrotic tissue. Once a wound has been converted via appropriate management to a clean-contaminated state it can be closed or reconstructed as soon as possible. If dealing with a relatively small contaminated wound in an area with available adjacent skin (such as on the trunk of a dog), a technique of 'en-bloc' debridement can be performed and the entire area excised and the resulting deficit closed primarily; this technique saves time compared to the process of on-going lavage and debridement followed by secondary closure.

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In some cases we may not elect to close a wound at the earliest opportunity. It may be cheaper to the client to allow a wound to heal by second intention, but do not under estimate the costs involved in ongoing open wound management, including dressing changes and repeated sedations.

In certain situations though, early reconstruction is strongly advised. These include wounds where: Vital structures are exposed, areas near joints where contraction will affect joint function, near eyelids or lips.

Surgical Principles and Techniques for Wound Closure

How we close the wound is as important as when we close the wound.

While handling the tissues and placing sutures we need to use aseptic technique, reduce contamination and minimise tissue injury; this will aim to preserve blood supply and therefore tissue oxygenation leading to enhanced healing.

Hallstead's principles of surgical technique still provide essential guidelines today:

- **Strict aseptic technique**
- **Gentle tissue handling**
- **Sharp anatomic dissection of tissues**
- **Preservation of blood supply**
- **Meticulous haemostasis**
- **Careful approximation of tissues**
- **Management of dead space**
- **Little or no tension across suture lines**

Basically once we have managed a wound to the point where we are able to close it, we do not then want to re-introduce bacterial contamination and devitalised tissue during our closure!

One of the most common faults is to place skin sutures too tightly, this causes pain, self-trauma, tissue ischaemia and likely wound breakdown. Skin sutures should gently appose the skin edges without crushing, if you are relying on the strength and tension of the suture to close the skin then breakdown is inevitable. Allowance should be made for swelling post-operatively. Closure of skin is improved with the placing of intradermal sutures to hold the edges in apposition prior to the placement of skin sutures. This stabilises the skin edges and means there is no need for any tension on the skin sutures, so reducing 'cut out' and wound breakdown.

Suture Materials

Suture materials are categorised according to a variety of properties:

Absorbable vs Non-absorbable

Mono-filament vs Multi-filament

Natural vs Synthetic

An individual suture material may then be assessed in terms of its flexibility, handling characteristics, its strength, relative knot security, loss of strength over time, capillarity and time to complete absorption.

Absorbable vs Non-absorbable: Absorbable sutures generally undergo degradation with a rapid loss of tensile strength within 60 days. Non-absorbable sutures retain significant strength beyond 60 days.

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Mono-filament vs Multifilament: Multifilament sutures are made by twisting or braiding multiple small strands into a larger suture. Mono-filaments are made from one strand made by extrusion.

Generally multi-filaments are easier to handle as they are more flexible, but their rough surfaces cause increased drag and can cut through the sutured tissue. The small spaces between the individual strands can harbour bacteria from contaminated wounds, and the presence of such suture material greatly increases the risk of wound infection in a contaminated wound.

Mono-filaments are less flexible and so more difficult to handle, but cause less tissue trauma and decreased bacterial adherence.

Natural vs Synthetic: Historically the first suture materials were of natural origin, (e.g.. cotton and linen). Synthetic materials are produced from chemical polymers.

The use of natural suture materials is now rare, remaining types in use are catgut, silk and stainless steel. Catgut is broken down by phagocytosis and its rate of absorption is unpredictable. Silk tends to be used for its excellent handling characteristics, usually to ligate vessels.

Synthetic absorbable sutures are absorbed by hydrolysis, which induces little tissue reaction. As they are made from uniform material, the rate of absorbtion is predictable.

Selection of Appropriate Suture Material

The aim of any suture is to hold together the tissues that have been cut until they are healed. It is therefore important to select the suture appropriate for each tissue based on the expected rate of healing for that tissue, but also considering any harmful effects the suture may have on the healing process.

Considerations include;

SIZE-The size of the suture material should be the minimum size possible to adequately hold the tissue while healing. Larger suture size results in more tissue trauma, and a greater amount of foreign material so increasing the risk of infection.

STRENGTH OF TISSUE-The suture should be at least as strong as the tissue through which it passes. The strength of the tissue and its ability to hold sutures without tearing depends on its collagen content and the direction of the fibres

LOSS OF SUTURE STRENGTH AND GAIN OF WOUND STRENGTH-We need our suture material to appose the tissue until it has healed. Therefore the loss of strength of the suture material as it is absorbed, must be matched by a gain in strength of the tissue as it heals. This is an important consideration in slowly healing tissues under constant strain such as tendons and ligaments.

CAPILLARITY-Fluid and bacteria can be carried into the structure of a multi-filament suture. Neutrophils and macrophages are larger and are unable to follow, leaving the bacteria safe from phagocytosis. For this reason the use of multi-filaments should be avoided in contaminated wounds, and where ‘wicking’ of fluid along the suture deeper into the wound can occur, such as with skin sutures, or intestinal sutures.

The ideal suture material should;

- Be easy to handle
- React minimally within the tissue
- Hold securely when knotted
- Create minimal drag through tissues
- Maintain adequate tensile strength until healing is complete

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- Have a rapid resorption without reaction once tissue healed
- Be easy to sterilise without changing property
- Not favour bacterial growth
- Be non allergenic.

In practice no such material exists, and a suture should be selected that best matches the properties required for the tissue and wound it will be used for.

SKIN- Synthetic monofilament suture material is recommended. Multi-filaments should be avoided due to capillarity and the risk of 'wicking' fluid and bacteria into the wound.

SUBCUTANEOUS TISSUE- Skin sutures are often removed 10-14 days post-operatively, but only 20% of the skins strength is returned by 21 days. In view of this we need to provide support beyond this period with the subdermal or subcutaneous layers. A synthetic absorbable material is recommended.

LINEA ALBA-Fascia is slow to heal, so prolonged support is required during healing. A synthetic absorbable suture that is slow to lose its tensile strength is normally used. Non-absorbable synthetic material can be used where delayed healing due to patient factors is expected.

HOLLOW VISCUS ORGANS- e.g. Bladder and intestines. A synthetic absorbable monofilament is advised. Multi-filaments may cause more trauma and tissue drag, and potentially harbour infection. Non-absorbable suture material can be used in the GIT where slow healing is anticipated- such as in the colon, or in the presence of peritonitis.

TENDONS AND LIGAMENTS- Slow healing is expected, and high tensile strength is required. Synthetic absorbable or non-absorbable suture material is used.

Needles

The use of 'swaged on' needles is always recommended. Swaged needles can have a diameter only slightly larger than that of the suture material, ensuring the minimum of trauma to the tissue.

Needle shape is selected depending on the depth and accessibility of the wound or organ to be sutured. Generally the deeper the wound, the more curved the needle. Straight needles may be used for skin, or in some cases tendon suturing. Curved needles are formed in an arc and described as their proportion of an entire circle- i.e. ¼, 3/8, ½, 5/8.

The cross section of the needle and its point have are an important consideration.

Round body needles have a sharp point, and penetrate the tissue by dilation of an initial puncture, these are least traumatic, but cannot be used on tougher material without rapidly blunting. Tapercut needles are round bodied, but at the tip are honed to have 2 or more cutting edges. Cutting needles are triangular in cross section and used on tougher tissue such as skin. Conventional cutting needles have the inside edge of the curve(towards the wound) as the cutting surface, reverse-cutting needles have the cutting edge on the outside of the curve, away from the wound edge, to prevent 'cut-out'.

Instruments and Handling

The size and type of needle holder used to grasp and manipulate the needle is determined by the characteristics of the needle, the location of the wound, and personal preference. Large heavy needles in tough tissue require wider, heavier jawed needle holders. Suturing inside a thorax requires longer needle holders.

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Intricate ophthalmic work requires small delicate needle holders such as Castroviejo type. The most commonly used needle holders are Mayo-Hegar, and Olsen-Hegar (incorporating scissor blades).

Needle holders should grip perpendicular to the needle, near its centre to prevent damage to the needle swage or tip. Gripping the needle holders in a ‘thumb-ring finger’ grip allows for the most precision.

Tissue forceps are used to stabilize tissue or expose tissue layers during surgery. They are available with a variety of tips, tissue forceps with large teeth (e.g. ‘rat-toothed’ forceps) should not be used to handle easily traumatised tissue. Most commonly used are Brown-Adson (small serrations at the tips) or DeBakey (interlocking ridges).

Knot Tying

The knot is the weakest point of the suture, the knot is formed by at least two throws formed on top of each other and tightened. The number of throws required to tie a secure knot depends on the suture material and suture pattern. Mono-filaments require a greater number of throws, multi-filaments generally require less throws. The beginning and end of a continuous suture line will require more throws than a simple interrupted suture.

Suture Patterns

Interrupted suture patterns vs continuous?

Advantages of simple interrupted patterns are greater security, and allowing the precise adjustment of tension at each point of suturing.

Disadvantages are that more suture material is used, this costs more and leaves more foreign material in the wound, they are also more time consuming (longer anaesthetic means greater wound infection risk).

Simple Interrupted

Quick and easy to apply, they are appositional unless excessive tension is applied; then they tend to invert the tissue. Used most commonly for skin sutures. Needle is passed from one side of the wound to the other, and a knot tied.

For skin closure the sutures are placed 3mm from the skin edge and about 5 mm apart. A common mistake is to over-tighten the suture leading to tissue necrosis, and cut-through. Leave cut ends long enough to assist with remova

Simple Continuous

A series of simple sutures with a knot at either end. Each bite is perpendicular to the wound edges, with the suture material advancing obliquely across the wound to begin the next suture. To end the suture, the end is tied to the last loop. A greater number of throws is required on the knot at the end and the beginning of a continuous suture.

Ford Interlocking

This is similar to a simple continuous suture, but with a modification so that after each pass of the needle the suture is partly locked. This pattern can be placed quickly, and may give better tissue apposition than a simple continuous, but uses a lot of suture material, and also if used in the linea alba, does not give as good a protection against herniation between sutures

Cruciate

An interrupted suture that is basically 2 linked simple interrupted sutures. Quicker to place than simple interrupted, but the tissue apposition is not as accurate.

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Sub-Cutaneous And Intra-dermal

Sub-cutaneous sutures are placed to eliminate dead space and ease tension on skin sutures; they are usually placed in a simple continuous fashion. The starting knot is buried below the dermis, and then vertical bites are taken each side of the wound and the suture advanced in between.

Intra-dermal sutures are used to appose skin edges, and may be used with skin sutures, skin staples, tissue glue, or on their own for skin closure. Horizontal bites of the sub-cuticular tissue are taken, with the suture advancing within the tissue.

Stapling

Skin staples are commonly used for skin closure, and the same principles as skin suturing apply- i.e. they should not be under any tension, and are best used where a sub-cuticular suture layer has already been applied to hold the skin in apposition. Make sure both skin edges have been penetrated, and the points of the staple meet to prevent rotation.

Wound Reconstruction Techniques

Background.

Wound reconstruction techniques are intended to ensure that either a wound can be closed without tension, or in areas with insufficient skin to achieve this, they allow 'extra' skin to be brought in and utilised. Tension on skin sutures is something that should be avoided at all costs. It leads to skin necrosis and wound breakdown, but is painful for the patient and likely to result in self trauma. Tension inevitably leads to the need for repeated procedures.

Not all wounds can be left to heal by secondary intention. They may be so large that this will take a very long time. Or their position may be such that the contraction associated with wound healing may cause distortion of adjacent structures (for example near and eyelid) or impair the function of underlying structures. For example, large wounds over the distal limb will limit the range of movement of the hock or carpus if left to heal in this fashion.

Anatomy

The skin of dogs and cats is very elastic which makes it easier to manage tension and forces affecting wounds. We can utilise the mobility of our patient's skin with limited risk of it becoming non-viable, if basic principles are adhered to. This mobility is possible due to the fact that cutaneous arteries supply significant areas of skin, so the skin can be moved without disrupting its blood supply. Also, this blood supply runs beneath the cutaneous muscles, and there are no attachments to deeper skeletal muscles or fascia, meaning that the skin and cutaneous muscles can be 'moved' as a unit.

Direct Closure of Skin Defects

In the case of elective wounds or resections, then prior planning is essential, the elasticity of the skin can be evaluated, the direction of maximum tension or 'pull' can be assessed, and any likely movement of limbs or head and neck accounted for. The incision and subsequent closure can then be planned to achieve a tension free and cosmetic result.

However, often the amount of skin resected means a closure without tension is not possible, or we are dealing with a traumatic unplanned wound.

The simplest of techniques are those that make use of elastic properties of the skin without resorting to additional incisions or skin flaps. The two most commonly used techniques are undermining and 'walking' sutures.

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Undermining is very effective at reducing wound tension, by a combination of blunt and sharp dissection. Loose connective tissue attachments below the skin are broken down, allowing greater mobility at the wound edges. Be aware that by doing this you are creating dead space, so where large areas are undermined, the dead space should either be controlled with drains or with pressure from bandaging.

'Walking' sutures can be used after undermining has been performed. Firstly, a bite is taken with the needle in the dermis of the undermined skin and then through the fascia of the wound bed relatively closer to the middle of the wound, when the suture is tightened, the overlying skin is advanced towards the wound centre. This can then be repeated closer to the closure. By doing this, the walking suture has two purposes. Firstly, it distributes tension away from the skin margin while closing down dead space. Secondly, it advances the undermined skin across the wound bed.

Walking sutures do have some disadvantages. They increase the risk of infection in a wound by adding to the foreign material present, and causing very localised areas of ischaemia. It is also possible that fixing the loose mobile skin of the patient to the less mobile fascia below, can cause discomfort in some patients.

If even after undermining, the wound still cannot be closed, then we can consider the use of multiple relaxing or releasing incisions. Staggered rows of full thickness stab incisions are made parallel to the wound, and as the skin edges are apposed, these incisions expand to create a mesh effect. The area must be bandaged with an appropriate dressing to allow the gaps created by the stab incisions to granulate, contract and epithelialise.

Local Skin Flaps

Where extra tissue is required to fill a deficit and achieve wound closure, skin flaps can be used.

The most commonly used skin flaps maintain a blood supply to the donor site via the subdermal plexus and are therefore known as random subdermal plexus flaps. Their blood supply does not have to be planned to a specific vessel. To maintain this blood supply the base of attachment must be broad, and usually the length to width ratio approximately 2:1.

These flaps are then usually described further in terms of their donor site attachment, so a flap with one attachment is a single pedicle, two attachments is a double pedicle. Further description relates to the way in which the flap is moved to the recipient site; commonly advancement or rotation.

Using this means of description, the most commonly used subdermal plexus flap is a single pedicle advancement flap. This helps close square or rectangular defects where tissue is brought from one side. This technique is very straightforward. The flap is created by making parallel incisions from each end of the wound, the length of these incisions should be up to twice the width of the flap. The resulting flap is undermined and elevated, leaving the base attached, and advanced forward to fill the deficit. The flap is sutured in place using subcuticular and intradermal sutures to evenly distribute the tension all along the flap. 'Dog ears' of redundant tissue will form either side of the base of the flap, this can be removed by cutting what is known as 'Burrow's triangles' from either side of the base.

Where a large deficit is present, and skin is available from both sides, then bilateral single pedicle advancement flaps can be raised and advanced from both sides to fill the deficit. This is sometimes referred to as an 'H' plasty due to the shape of the resulting closure.

A single pedicle rotation flap is used to close triangular deficits where direct closure would lead to distortion of adjacent structures, such as the eyelid. A semicircular incision extending from one side of the defect is made, the whole flap elevated, and the tip of the flap sutured to the furthest point of the defect, the edges are then sutured, which distributes tension towards the base of the flap.

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Axial Pattern Skin Flaps

Rather than the random nature of subdermal plexus flaps, an axial pattern flap has a defined area and anatomical borders. This section of tissue is supplied by known direct cutaneous arteries and veins. This blood supply is left intact and a self contained 'package' of tissue can be moved to an adjoining area, bringing its own blood supply with it.

These vessels and the tissue they supply have been mapped out in the dog and cat and have similar borders in each species. The more elastic nature of cat skin means these flaps will often cover more distal structures than in the dog.

The fact that the skin we are moving into the recipient site has its own known established blood supply is the most important factor. This means we are not limited in terms of length/width ratios or in keeping an intact 'base' of skin to the flap. This means that axial pattern flaps can contain a large area of skin, and their survival is greater than a comparable subdermal flap. The blood supply also makes infection less likely.

Axial pattern flaps can be used to place into sub-optimal wound beds, such as uneven surfaces or exposed bone, tendon or cartilage. These flaps require no specialised equipment, and their locations are widely described.

However, complications can occur.Other than closing the donor site, which will require mobilisation techniques previously described (namely undermining and walking sutures), then the drawbacks are mainly cosmetic. This means that hair colour and direction of growth may differ to the surrounding area, and also any subcutaneous fat and glandular tissue will be transferred with the flap into the recipient site.

Complications can include distal flap necrosis, usually due to poor pre-operative planning leading to too large a flap being removed and exceeding the blood supply. Infection is not common due to the good blood supply, but can occur. If local infection is controlled, survival of the axial pattern flap is not adversely affected.Other complications can include oedema, seroma formation and dehiscence of the donor site. Passive or active drains should be placed for at least 3 or 4 days to reduce seroma formation.

The same principles apply whichever axial pattern flap is being dissected. Study the defined borders of the donor site and locate them on the animal. The borders are then sharply incised and a plane of dissection established beneath the cutaneous muscles. Work back towards the vascular pedicle and leave a cushion of fat around it to protect the vessels from kinking when the flap is relocated.

While the simpler techniques described earlier will be sufficient for the majority of wounds, it is important to spot the cases where they are unlikely to be of use and rather than using them and risking wound breakdown, a more advanced technique should be used in the first instance.Other well described axial pattern flaps allow reconstruction of the head and neck, forelimbs, hindlimbs and perineal areas.

Skin Grafts.

Skin grafts in cats and dogs are used almost entirely to reconstruct large skin deficits in the extremities of the limbs. In these areas there are several problems presented that often mean other techniques cannot be used. Direct closure of the defects is often impossible due to lack of available skin, similarly so for the use of subdermal plexus flaps.

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These defects may be too far down the limb for axial pattern flaps to reach. The risk of leaving such defects to heal by secondary intention is that the scarring and contraction that results may restrict limb movement.

Performing skin grafts can be very time consuming and involved, so before the technique is used, be sure no alternative is available. Because of this skin grafts sometimes have the reputation of being a last resort. This is not always true, but great consideration should be given to the levels of care and experience available before embarking on this route.

Skin grafts need a stable, even, well vascularised wound bed to be placed onto. After placement the area must be capable of being bandaged and efficiently immobilized. Because of this requirement, the use of skin grafts is realistically limited to the lower limbs in our patients.

It is essential to appreciate what is termed as graft 'take'. Bear in mind that unlike the skin flaps of axial pattern flaps, the graft has no blood supply of any kind and survival is dependant a series of processes which must occur and not be disturbed. The graft needs to adhere to the bed by the formation of initially fibrin and then fibrous tissue. Nutrition is initially provided by plasmatic imbibition, where the graft absorbs serum proteins and erythrocytes from the recipient tissue, causing the graft to take on a swollen and discoloured appearance - do not confuse this with necrosis. Later, capillary buds from the recipient tissue grow and anastamose with pre-existing capillaries in the graft- any movement of the graft during this stage is likely to cause massive disruption to this process and failure to 'take'.

Skin grafts are described in 2 ways, firstly by the thickness of skin harvested;

Full thickness grafts contain the epidermis and the whole of the dermis. They are the most commonly used in small animal patients. Because they contain all the layers of the skin they are not so easily damaged when handled and sutured into place. They also give a good cosmetic result as they bring all the skin structures with them such as hair. Their thickness means that nutrition during the 'take' period is more critical and they may be more prone to fail.

Partial thickness grafts include the epidermis and part of the dermis. They are further described as thin, medium or thick split thickness grafts. Their use is more common in humans than in small animals, this is for a number of reasons. They are more fragile than full thickness grafts, because they do not contain all dermal structures they give a poor cosmetic result, also they usually require expensive equipment to harvest them at a pre-determined constant depth.

Secondly, the graft can be described by the coverage given. Most commonly in small animals, we use sheet grafts to give total coverage of the wound and give a good cosmetic result. Pinch, punch and strip grafts are smaller and give only partial coverage when placed in a granulation bed, their aim is to promote epithelialisation but the cosmetic result is often poor.

Summary

WHAT wounds to suture- we are only going to suture Clean or Clean-Contaminated wounds.

WHEN to suture the wound- reconstruct wound as soon as possible once has been converted to a clean/clean-contaminated state and all ischaemic tissue removed

HOW to suture the wound- reconstruct without tension on skin, using appropriate suture material, of appropriate size, and using Hallstead's surgical principals so as not to cause further trauma.

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