

Best practice of suturing wounds within pre-hospital setting



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Title: Review of best practice of suturing wounds within the pre-hospital and emergency department setting.

Essay

Suturing as a treatment for cutaneous wounds has been known to mankind for millennia. The Indian Surgeon Susruta (AD c380-c450) described techniques for skin closure using flax, hemp, and hair. Jaws of the common black ant were also known to be used at about this time. Galen recommended silk and catgut in about 150 AD. A Roman, Avicenna, is credited with describing the first monofilament suture in the form of pig bristles for infected wounds. (Moy R L et al. 2002)

Suture material may have evolved from the first recorded human hair and fibrous vegetable material to highly sophisticated sterile materials with integral needles, but the basic optimum technique of “ closing dead space, supporting and strengthening wounds until healing increases their tensile strength, approximating skin edges for an aesthetically pleasing and functional result, and minimizing the risks of bleeding and infection.” are largely unchanged. (Scott M 1993)

In consideration of this subject, this essay will consider suturing in the context of the suturing of wounds in an Accident and Emergency Dept. or the pre-hospital setting as opposed to other considerations of suturing that are possible.

The different ways of suturing.

There are a great many different ways to suture a wound. The method employed will depend on factors such as the site and nature of the wound as much as it depends upon the training and experience of the operator

In the general context, wounds may be closed by either primary or secondary suturing. Primary suturing takes place shortly after the injury and requires minimal cleaning and preparation. Secondary closure takes place when a delay of more than 24 hrs has occurred and requires a surgical “freshening” of the wound to remove and infection and granulation tissue. The presence of reddening or oedema of the wound margins, discharge of pus, persistent fever, or systemic toxicity are indications that primary closure should not be attempted as any infection in the wound must be controlled before closure takes place.

If the decision to suture is taken, this should ideally (with very few emergency exceptions) take place in controlled sterile surroundings with proper suturing equipment.

In terms of different ways of suturing, one can note that the textbooks suggest many different varieties of mechanisms with varying degrees of sophistication for closing skin in different circumstances. In broad terms however, sutures can be interrupted (single) or continuous (running suture), transcutaneous or subcuticular.

Associated Infection risks to suturing in the pre hospital setting and the emergency department

There is a considerable literature relating to bite wounds and the rationale underpinning the decision whether or not to suture in the pre-hospital setting. The authoritative papers in this area have identified *Staphylococcus*, *Streptococcus*, *Eikenella*, *Pasturella*, *Proteus*, *Klebsiella*, *Hemophilus*, *Enterobacter*, *Capnocytophaga* *carnivorans* (DF-2) and *Bacteroides* species as being frequent contaminants of animal bite wounds and such wounds must receive careful antiseptic treatment prior to suturing. (Morgan M et al. 2007)

One definitive study on the subject of whether prophylactic antibiotics are important over and above standard wound cleaning and debridement found that a greater number of patients developed wound infections if they did not receive prophylactic antibiotics with deeper wounds being more likely to develop infection than superficial ones. (Dire D J 2001).

In broad terms, suturing must be carried out with rigorous aseptic technique. By definition, this refers to the absence of pathogenic organisms. It may well be that the wound to be treated is already infected by its nature (viz. an animal bite or a dirty wound) but the aseptic technique is central to ensuring that no further infection is introduced into the wound. The main principles of an aseptic technique include:

Keeping the exposure of susceptible sites to a minimum

Ensuring appropriate hand decontamination prior to the procedure

Using gloves (sterile or non-sterile, depending on the nature of the susceptible site)

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Ensuring that all fluids and materials used are sterile

Checking that all packs used are sterile and show no evidence of damage

Ensuring that contaminated and non-sterile items are not placed in the sterile field

Not reusing single-use items

Reducing staff and/or bystander activity (wherever possible) in the immediate vicinity of the area in which the procedure is to be performed.

(HCAI 2008)

In any discussion of infection risks, one must not overlook the possibility of the reverse infection of healthcare professionals becoming infected by coming into contact with tissue fluids from the patient. Scrupulous attention to the Health Dept's published guidance on protection against infection with blood-borne viruses for healthcare professionals in 1998 (UKHD 1998) should help to minimise the risk of blood-borne virus transmission to health care workers from patients. Suturing always carries the attendant risk of a needle prick injury even in the most experienced hands. An unexpected move from the patient, a sudden thread break or even inattention, can easily have major repercussions if it results in a stick wound to the operator. (Bosch X 2003)

Pro's and cons of suturing.

The purpose of a suture is to hold the edges of a wound together in good stable apposition until the natural healing processes are sufficiently well established to make the support provided by the suture material unnecessary and redundant.

There is a distinct difference however, between the results from good and bad suturing. For example, if sutures are made excessively tight, the tissue becomes ischaemic from the pressure. This encourages persistence of infection and tissue necrosis. Too many sutures will also make a wound ischaemic. Materials which are multifilament or braided can allow bacteria to enter the wound (by wick action) but can exclude phagocytes. It is therefore appropriate to draw distinctions between the results obtained from optimal suturing and poor suturing.

Sutures are not the only mechanism available for achieving wound closure. Synthetic and natural tissue glues, surgical staples and flexible non-tensile tapes all have their place in maintaining wound edge apposition. Choice of technique is dependent on the anatomy of the area to be closed, whether it is going to be exposed to movement stresses, as well as the type and depth of the wound itself. Criteria for the choice of closure is a vast subject and beyond the scope of a modest essay, but decisions for optimum means of wound closure have great implications for successful healing and good aesthetic results. (Spotnitz W D et al. 1997)

Training involved to enable medical staff to perform suturing.

Training staff to suture requires a combination of a knowledge of the physiology of the healing processes, anatomy and clinical experience. There are a number of teaching aids commercially available for suture training.

It is not simply a matter of learning how to suture, but the motor skills are also capable of considerable enhancement once the basic techniques are acquired. (Judkins T N et al. 2008)

Suturing v non suturing of wounds. Are there benefits to these alternative methods?

Suturing has been tried and tested with modern materials for many years. It does have the downside that, in inexperienced hands it can have sub-optimal effects with poor aesthetic and functional results, wound ischaemia if done too tightly and raises the possibility of pathogens entering the wound along the suture line.

Alternative methods of skin closure have been developed over the last 40 years including various glues and sealants. The majority are fibrin / thrombin based. The current commercially available glues are bacteriologically and virally sterile (which contrasts to the biologically derived early varieties). Glues have the downside that they are not good in sites that are under considerable tensile stress. Full thickness wounds, particularly those that involve the deeper structures need deep sutures to minimise stresses in the skin. Glues are best for minor skin wounds. (Mintz P D et al. 2001)

Adhesive strips are used for minor wounds and have the advantages that they have less of an inflammatory reaction than sutures, lower infection

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rates and no risk of abscess development at suture locations. They also have greater tensile strength when used late in the healing process and are cheap.

Staples are used for wound closure primarily in surgical situations. They require considerable practice and expertise in use for optimal results. Some authorities advocate their use in the pre-hospital setting (particularly on the sports field) to minimise blood contamination and to allow suturing at a later stage. (Orchard J W 2004)

Paramedics suturing skills within pre hospital setting.

There are a number of studies which have been done which demonstrate that, within the hospital setting, to use paramedics for suturing duties can reduce the number of patients who are waiting to see a medical practitioner by up to 25%. This study also noted a patient satisfaction rate that was superior to having to wait to see a doctor or nurse. There was no difference in the morbidity rates after one month. Those who object in principle to this use of a paramedic on the grounds that it would require training beyond the expertise of the practitioner would find the argument hard to support when one considers that paramedics are currently trained in more sophisticated skills such as intubation, cardiac resuscitation and critical patient assessment.

Hale presented a prospective double blind trial to determine if Paramedics could determine which wounds could be safely repaired in the pre-hospital situation and found a very high correlation (almost 100%) between

emergency specialists and paramedics in the wounds that were excluded
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from pre- hospital repair. The paramedics tended to be slightly more cautious than the emergency specialists in identifying which wounds should be brought into the hospital setting. (Hale D et al. 2000)

Different types of sutures and there pro's and con's, number of days that sutures should be in situ for.

Even a brief overview of available suture materials would extend to many pages. In general terms therefore one has to consider the two major categories of Absorbable and Non-absorbable suture material. In general terms, absorbable sutures are to be preferred unless there is a need to fixate an anatomical structure. These two categories can be further subdivided into the braided group (which have properties of tissue drag and a capillary filling effect but handle well) and the monofilament group which slide easily but can be more difficult to retain a knot.

Of the absorbable varieties, the modern synthetic types undergo hydrolysis in the tissues, produce minimal tissue reaction and their degradation products are CO₂ and H₂O. Examples are Polyglycolic acid, Polydioxanon and Polylactate

Studies show that all three retain their tensile strength until clinical tissue healing is complete with Polyglycolic acid being 60% absorbed within 21 days and Polylactates being 75% absorbed in 14 days. (Hsiao W C et al. 2000)

Non-absorbable suture materials include silk, linen and cotton with synthetic varieties including nylon and Dacron and wire.

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