INTRODUCTION

Caesarean section is a common operation with no agreed standards on operative techniques and materials to be used. The skin layer can be repaired by sub cuticular stitch immediately below the skin layer,or interrupted stitches or with skin stapler ***(Fiona Alderdice et al.,2010).***

The goal of any skin closure technique is to produce appropriate skin approximation and adequate healing with minimal wound complication , scarring, pain, and cost ***(Alon et al., 2009).***

The first report of the use of subcuticular sutures for wound repair was in 1889, and the first disposable skin stapler was produced by ethicon in 1978 ***(Alon et al.,2009).***

The excessive wound healing in both hypertrophic scars and keloids is found only in humans and occurs in 5-15% of wounds. Both types of scars tend to be familial, but this is much more true for keloids Studies have consistently demonstrated that persons of certain races are more susceptible to keloid scar formation. Individuals with darker pigmentation, black persons, and Asian persons are more likely to develop keloids ***(Edward Newsome et al., 2006).***

The goals of wound closure include obliteration of dead space, even distribution of tension along deep suture lines, and

maintenance of tensile strength across the wound.It is intended to achieve adequate tissue tensile strength after approximation and eversion of its epithelial portion. Methods employed for mechanical wound closure include staples,tape adhesives,and sutures ***(Aliya Islam and Ambreen Ehsan, 2011).***

Although staples have been shown to be faster to apply than sutures in both general surgical abdominal procedures and obstetrical procedures, the clinical benefit of this decreased intraoperative time remains unclear. It may have a greater effect on patient care in considering use of staples in a busy labour and delivery unit ***(Alon et al.,2009).***

AIM OF THE WORK

The aim of the study is to detect the incidence of hypertrophic scar after ceaseran section delivary in Aswan and prevention of it by comparing between skin closure using skin stapler or skin glue in previous c.s. and its impact on formation of hypertrphic scar.

DEFINITION AND INCIDENCE OF HYPERTROPHIC SCAR AND KELOID

Keloid scar (KS) is a benign hyperproliferative growth of dermal fibroblasts characterized by the excessive deposition of extracellular matrix components in agenatically susceptable individuals and that never becomes malignant.Although its exact cause is still unknown.it is thought that the condition is due to a failure to turn off the healing process. The incidence of KS has been estimated to be approximately 4-6 % in the general population and up to 16 % in people of African cohorts general ***(Emami et al., 2012).*** Increased familial aggregation, a higher prevalence in certain races, parallelism in identical twins, and alterations in gene expression favor the contribution of genetic risk factors to the development of KS**.** Whil hypertrophic scar appears to be raised above the skin level; however, it is distinct from a keloid in that it stays within the confines of the initial wound and increases in size by pushing out the margins of the scar, not by invasion of surrounding normal tissue. Incidence of hypertrophic scar after surgery is 40 -70% **(Gauglitz et al., 2012).**

Table (1): Distinguishing characteristics for hypertrophic scars and keloids, modified from the German S2k guidelines for the therapy of pathological scars (hypertrophic scars and keloids).

Hypertrophic scar		**Keloid**
Incidence	Often	Rare, correlates with skin type
Extent	Does not go beyond original wound	Goes beyond original wound
Occurrence	< 6 months after injury	> 6 months after injury
Regression	Frequent	No regression
Prior injury	Yes	Yes, also minimal trauma
Localization	Entire skin surface	Entire skin surface, often ear, sternum, shoulder girdle
Genetic predisposition	Not known	Yes

HYPOTHESES ON THE ETIOLOGY OF PATHOLOGICAL SCARRING

1- Keloid Genetics

The involvement of familial inheritance is indicated by clinical evidence showing that patients with darker skin are 15 times more likely to develop pathological scars, primarily keloids, and that these scars are absent in albinos ***(Miller et al.,2005).***

potential keloid-associated loci in Japanese, African-American, and Han Chinese families have been identified on chromosomes 2q23, 7p11, and 10q23.31, respectively Chen Y, Gao JH, Yan X, et al. [Location of predisposing gene for one Han Chinese keloid pedigree] ***(Zhonghua et al., 2007).***

Although the responsible genes have not yet been identified. Moreover, genome-wide association studies have shown that in the Japanese population, 4 SNP loci (rs873549, rs1511412, rs940187, and rs8032158) in 3 chromosomal regions (1q41, 3q22.3–23, and 15q21.3) exhibit significant associations with keloids. Of these, rs873549 demonstrated the most significant association ***(Nakashima et al., 2010).***

Recent data also suggest that carriers of specific major histocompatibility complex (MHC) alleles, in particular HLA-

DRB1*15, HLA-DQA1*0104, DQB1*0501 and DQB1*0503, are at increased risk of developing keloid scarring. In addition, distinct immunophenotypical profiles can distinguish between keloid and hypertrophic scars. Keloid and hypertrophic scars are multifaceted aberrations of the healing process with as yet incompletely understood aetiologies. Current data suggest a genetic susceptibility with a strong immunogenic component to dermal fibrosis with MHC genes being implicated**.** Some genetic markers have been reported to have significant importance in diagnosis, prognosis, and development of Keloid ***(Brown and Bayat, 2009).***

2-Mechanics Theory

The skin injury-wound tension theory is a milestone in our understanding of keloid formation. Keloids are frequently seen on the anterior chest and scapular regions but rarely on the scalp and anterior lower legs ***(Ogawa et al., 2012).***

Such site specificity can change when circumstances alter the local mechanics. For example, Africans and African-Americans often develop scalp keloids because their tightly braided hair styles result in increased skin tension ***(Louw , 2000).***

3- Endocrinological Hypothesis

Keloids are rare in parts of the body that lack sebaceous glands, such as the palms and soles; Moreover, sebum production

is highly active in adolescence and early adulthood, which are periods that are associated with high incidences of keloid ***(Fong et al., 2002).***

4- Metabolic, Circulatory, Immunological, and Nutritional

Abnormal metabolic products have been detected in HSs and keloids. Keloids and HSs have higher adenosine triphosphate (ATP) levels; moreover, ATP levels in keloids are still high 10 years after the injury, although as time passes after the trauma these ATP levels drop.,However, it is unclear how these metabolic changes, including hypoxia in the central part of keloids, contribute to the formation of pathological scars and whether they are causes or results. ***(Ueda et al.,1999).***

With regard to circulation dynamics, many cases of severe keloid are associated with high blood pressure ***(Arima et al., 2012).***

Immunological mechanisms may also contribute to scar pathogenesis: the eluates of keloids but not HSs contain antinuclear antibodies against fibroblasts ***(Janssen , 1982).***

In the nutritional hypothesis, it is suggested that pathogenic scars are caused by inadequate fatty acid nutrition. ***(Louw , 2007).***

PHASES OF NORMAL CUTANEOUS WOUND HEALING

Types of wound closure

Primary apposition/intention

This occurs with approximation of wound margins using simple methods such as sutures, tapes, glue or mechanical methods within 12-24 hours of the incision being made. It occurs in clean, fresh wounds in well-vascularized areas. The wound may be treated with irrigation and debridement and the tissue margins are approximated precisely. These wounds are often the most cosmetically pleasing.

Secondary healing/intention

Commonly used in the management of infected or difficult to approximate wounds, this method of healing allows closure of an open wound via re-epithelialization and wound contraction by myofibroblasts. Regeneration of epithelial cells alone cannot restore the original architecture. Secondary healing relies on ingrowth of granulation tissue from the wound margins and deep tissue, followed by accumulation of extra-cellular matrix (ECM) and laying down of collagen.**(Zuhair Nawaz George Bentley et al 2010).**

Healing of acute wound:

There are four phases involved in acute wound healing :

1- Homeostasis (4 to 6 hours)

Haemostasis begins immediately following the tissue injury occurs. Damaged endothelium within the wound releases von-Willebrand factor (vWF) and tissue thromboplastin. vWF facilitates platelet adhesion to sub-endothelial collagen and discharges adenosine diphosphate (ADP) and thromboxane A2 leading to platelet aggregation. Alpha granules within the platelets release platelet-derived growth factor (PDGF), and transforming growth factor-beta (TGF-b). PDGF is chemotactic for fibroblasts, neutrophils and monocytes and, along with TGF-b, lead to prolific collagen construction. Tissue thromboplastin activates the coagulation pathways producing fibrin. Fibrin provides the structural support for the inflammation phase. ***(Vandercappellen et al., 2010)***

2-Inflammation:

Early inflammatory phase (day 1–2): activation of the complement cascade e polymorphonuclear leukocytes (PMNs) infiltration which adhere to endothelial cells in adjacent blood vessels (margination) and begin to move through vessel walls (diapedesis). They are attracted to the site by fibronectin,growth factors, and kinins. Neutrophils phagocytize debris and bacteria and also kill bacteria by releasing free radicals. They cleanse the wound

by secreting proteases that break down damaged tissue. The cut edges of dermis begin to exhibit increased mitotic activity and epithelial cells from the edges begin to migrate and proliferate, depositing a basement membrane***(Petreaca et al., 2007)***.

Late inflammatory phase (day 2–3): monocytes replace PMNs as the predominant cells in the wound by 2 days after injury. Monocytes are attracted to the wound by the release of complement, clotting components, immunoglobulin G and cytokines***(Gillitzer et al., 2001)***. The monocytes then undergo phenotypic change to macrophages, which are the key regulator cells in this phase. Macrophages have two key roles in the late phase:

1. Phagocytosis and proteolytic enzyme release which aid in the debridement of the wound.

2. Primary producers of growth factors (platelet-derived growth factor, TGF-b) stimulated by the low oxygen content of their surroundings. These factors are responsible for inducing and accelerating angiogenesis and stimulating cells to reepithelialize and deposit of new ECM ***(Brown et al 1999).***

3-Regeneration and proliferation (day 3–14): This phase starts at day 3 and can continue for further 2-4 weeks. During this phase there is deposition of ECM, fibroblast migration and formation of granulation tissue. Formation of granulation tissue/fibroplasia/matrix deposition: this occurs simultaneously

with angiogenesis. Fibroblasts begin accumulating in the wound site and release PDGF and TGFb which are mitogenic for epithelium and fibroblasts. Proliferation of epithelial cells and fibroblasts lead to ECM production. ECM is composed of collagen, adhesive glycoproteins and proteoglycans. Examples of glycoproteins are fibronectin and laminin which help link the components of the matrix. Proteoglycans help regulate the structure and permeability of the matrix. Hypoxia also contributes to fibroblast proliferation and excretion of growth factors, though too little oxygen will inhibit their growth and deposition of ECM components, and can lead to excessive, fibrotic scarring ***(Schneider et al., 2007).***

Angiogenesis: it occurs at 3-5 days concurrently with fibroblast proliferation. Angiogenesis is imperative because the activity of fibroblasts and epithelial cells is oxygen- and nutrient dependent. Stem cells of endothelial cells, originating from parts of uninjured blood vessels, develop pseudopodia and push through the ECM into the wound site to establish new blood vessels***(Tang et al., 2004).*** Hypoxia stimulates monocytes to release vascular endothelial growth factor which is mitogenic for endothelial cells leading to further angiogenesis. ***(Satish et al., 2005).***

Re-epithelialization: the formation of granulation tissue in an open wound allows the re-epithelialization phase to take place, as epithelial cells migrate across the new tissue to form a barrier between the wound and the environment. Basal

keratinocytes from the wound edges and dermal appendages such as hair follicles, sweat glands and sebaceous glands are the main cells responsible for the epithelialization phase of wound healing. Increase in mitotic activity of the basal epithelial cells modulated by several growth factors encourages migration over the matrix leading to re-establishment of stratified epithelium ***(Gillitzer et al., 2001).***

4-Remodelling and scar maturation (day >7) Constant synthesis and remodelling of ECM with concurrent granulation tissue formation can occur for years after initial injury. The maturation phase begins when equilibrium between collagen deposition and degradation occurs, usually around 3 weeks. Type III collagen, which is prevalent during proliferation, is gradually degraded and the stronger type I collagen is laid down in its place. Metalloproteinases, whose activity is reliant on zinc ions, has the potential to impair or improve wound healingin this stage***(Desmouliere et al., 2005).***

Contraction is a key phase of wound healing. If contraction continues for too long, it can lead to disfigurement and loss offunction. Contraction commences approximately a week after wounding, when fibroblasts have differentiated into myofibroblasts. Contraction can last for several weeks and continues even after the wound is completely re-epithelialized. The scar usually achieves its maximum tensile strength by 12 weeks, with approximately 70e80% of its original strength***(Feng et al., 2007).***

Excessive wound healing

Keloid and hypertrophic scarring

Hypertrophic and keloid scarring are forms of excessive healing unique to humans. Keloid is defined as an abnormal scar that grows beyond the boundaries of the original site of skin injury,compared to hypertrophic scarring which is limited to the wound margins, with a potential to regress spontaneously***(Gauglitz GG, et al 2011).*** Both types can cause significant amorphous growth which can lead to symptoms such as pain and pruritus as well as the significant cosmetic implications. Both are difficult to manage and treat, with several methods available. Keloid and hypertrophic scarring are very different entities. Pathophysiological differences between the two are still to be clearly defined.

The major differences are described in

Differences between keloid and hypertrophic scarring

- Keloid Hypertrophic
- Appearance Raised extending beyond wound margins Raised confined towoundmargin
- Typical sites Sternum, back, ear lobes, shoulder More common over flexor,burns
- Age Puberty to 30 years Any age
- Uncommon in children More common in children

- Racial groups affected Black; Hispanic; Polynesian; Chinese; Indian Can occur in any race
- Pathology Excessive collagen synthesis rate and glycosaminoglycan deposition
- Normal collagen synthesis with randomly organized collagen fibres
- Large, thick collagen fibres composed of numerous fibrils closely packed together
- Both have increased collagenase activity
- Immunology Increased immunoglobulin G and C3 levels No associations
- M: F F>M (? Due to ear piercings in women) M ¼ F
- Genetic predisposition Possible None
- Wound contracture No Yes
- Recurrence Yes; high likelihood No; usually growth subsides with time
- May even regress
- Treatment Debulking or excisional surgery; intralesional steroids; cryotherapy; pressure; siliconesheeting; laser therapy, radiotherapy
- As with keloids