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FIELD APPLICATIONS OF SOME TENSION RELIEVING PLASTIC TECHNIQUES FOR CUTANEOUS RECONSTRUCTION

(With 7 Figures)

By

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التطبيق الحقلي لبعض تقنيات تخفيف الشد التقويمية لاعادة بناء الجلد

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قد يستمر الشد الغير ملائم في بعض الجروح الجلدية المكتسبة وذلك حتى بعد القيام بالحفر تحت الجلد مما يتعذر معه إغلاق مثل هذه الجروح. وفي هذه الحالات يجب التبصر في استخدام طرق تقويمية إضافية لتخفيف هذا الشد مثل الحز الأرتخائي والطرق التقويمية الأخرى. ومن هذا المنطلق كان هدف البحث القاء الضوء علي استخدام الحز النقطي وكذلك كل من التقنية التقويمية علي هيئة Z وعلي هيئة V إلى Y في إغلاق وعناية بعض الجروح لحالات إكلينيكية تعاني من إصابات جراحية بالجلد. وقد تم استخدام الحز الأرتخائي النقطي في إغلاق الجروح الجلدية عقب استئصال أورام ليفية متفرحة في منطقة مفصل العرقوب وكذلك عقب استئصال قرحة ناتجة عن ورم للخلايا ألد قلية وأخري خشنه بجوار مآق العين الداخلي في الحمير. وكذلك تم استخدام الحز التقويمي علي هيئة Z للمساعدة في غلق الجلد عقب استئصال قرحتين غير ملتئميتين من الجدار الخارجي الأيسر لمنطقة البطن والصدر في الحمير، علاوة علي استخدام الحز التقويمي علي هيئة V إلى Y لتمكين إحدى الأبقار الهولوشتين من فتح فمها وذلك عقب استئصال رباط ليفي كان يطوق كلا الفكسين العلوي والسفلي. ومن خلال هذه الدراسة يمكن القول بأنه عند استخدام هذه التقنيات التقويمية البسيطة أمكن تفادي اندمال الجروح الجلدية بتكوين الأنسجة الليفية الثانوية الغير مستحبة لتأثيرها علي وظيفة الجزء المصاب وعلي مظهر الحيوان حيث تم اندمال معظم الجروح في الحالات موضع الدراسة بالاندمال الطبيعي الأول.

SUMMARY

This article will throw the light on the use of mesh expansion technique "punctate relaxing incisions" and sliding flap techniques "Z and V-Y plastic incisions" for management and closure of some clinical surgical skin disorders. Punctate relaxing incisions were performed after excision of ulcerated soft fibroma from the lateral aspect of the hock joint, an

unhealed mastocytoma and granulating ulcers close to the medial canthus of the eye and a fibropapilloma in front of the scapula in donkeys. The Z-plastic technique was performed in two donkeys suffered from unhealed ulcer at the lateral aspect of the flank region and chest wall; V-Y plastic technique was used to widening the mouth cavity in a dairy cow suffering from a scar band encircling and tying up both jaws. First intension healing was satisfactory in most treated cases and these techniques were proved to be helpful to avoid the undesirable effect of second-intension healing on the function of the affected area and cosmetic appearance of the animal.

Key words: *Plasticsurgery, cutaneous reconstruction*

INTRODUCTION

On occasion, traumatic or elective wounds are of sufficient dimension that conventional suture closure is difficult or impossible and second intension healing would have unfavorable effect on appearance or function (Myers, *et al.*, 1965 and Harari 1993). Insufficient skin surrounding the wound or continuous mobility of the wounded area may cause considerable skin retraction and allow healing by contraction (Swaim 1993 and Abou-El-Ella 2005). Because secondary healing can be and is usually prolonged, reconstructive surgery techniques should be considered as alternatives to hasten the healing process, return the horse to early function, and defray the total costs incurred by the owner in managing a wound allowed to heal by second intension (Blackford *et al.*, 1991 and Hendrickson and Virgin 2005).

Ulcerated mastocytoma is an infrequently seen tumor of mast cell in the skin and subcutaneous tissues. The natural history of mast cell tumors is difficult to predict as they can behave in an extremely aggressive or benign manner (London *et al.*, 2001). The predilection sites are the skin of the eyelids, neck, and extremities. Other reported sites are in deeper structures of the cervical region, trachea, and the floor of the nasal cavity. Surgical excision is preferred for well-defined mastocytoma and results in good tumor control (Cotchin, 1977 and Sundberg *et al.*, 1977). Fibromas and fibropapillomas are benign masses occur most frequently on the limbs and head. The majority of tumors are round to oval intradermal or subcutaneous masses. They are firm, rubbery and gray/white on cut surface. The tumor cells are of relatively mature fibroblasts producing an abundant mature collagen (Jones *et al.*, 1997 and Susan and Asa Mays, 1998).

The objective of suture closure of any traumatic or elective wound is to accurately appose the margins, without inversion, in an atraumatic fashion (Myers *et al.*, 1965). Reconstruction should not be limited to slowly healing or nonhealing wounds but can also be used to cover fresh surgical wounds created by excision of large neoplastic or granulomatous lesions (Gregory and Gourley 1990). Pressure wounds can be extremely difficult to treat and an advancement flap or pedicle graft may be required for closure (Susan and Asa Mays 1998).

Punctate relaxing incisions are used if substantial undermining of the wound cannot be helpful for approximating the wound edges without undue tension. A series of small parallel staggered incisions are made in the skin adjacent to a wound to release tension in wound closure (Bailey, *et al.* 1986). Two or three staggered rows of incision may be created, depending on the amount of tension relief desired. This form of relaxing incision is more cosmetic and accelerates the healing process (Swaim and Henderson 1990; Swaim and Scardino 1993; Swaim 1990 and 1993 and Pavletic 1993).

Reconstructive surgical techniques, including local skin flaps or grafts, may prove useful to cover defects or as a method of reducing tension (Harari, 1993). Local skin flaps is obtained immediately adjacent to the defect, and include those relocated by advancement as V-Y or Z-plasty. In case of Z-plasty two interdigitating triangular flaps of skin are relocated to allow a gain in length or relaxation in one direction due to shortening of the skin in the opposite direction. When a Z-plasty is used as a relaxing incision, all of the limbs of the Z should be of equal length, around 60° angles are made adjacent to the defect, with the central limb of the Z in the direction in which relaxation is needed (Swaim, 1980; and 1993; Vig, 1992, and Pavletic, 1993).

V-Y plasty is a form of relaxing incision that provides for relieving minor tension in small areas. The V shaped incision is made in the skin and undermined all around as needed then advanced over the defect after excision of the scar tissues. Suturing is started at the ends of the arms of the V and continued until the remainder of the defect is closed as the stem of the Y (Swaim and Ralph 1997).

MATERIALS and METHODS

Eight cases (seven donkeys ranged in age from 3 to 7 years old) and a Holstein dairy cow 4 years old were examined for the presence of skin disorders that not responded to both systemic and topical

management. The lesions were unhealed ulcers (three donkeys), soft ulcerated fibromas (two donkeys), ulcerated mastocytoma (one donkey); fibropapilloma (one donkey) and adhesive fibrous band encircling and tying up both jaws in a Holstein dairy cow. Clinical examination and assessment of the affected animals overall health status was performed as a pre-operative evaluation.

All Patients were sedated with intramuscular injection of xylazine 2%* in a dose rate of 1.2 mg/kg body weight for donkey and 0.1 mg/kg body weight for the cow. After routine surgical preparation analgesia in most cases was achieved through a field block infiltrations and topical application of Lidocaine 2%** . Samples from four cases that showed evidence of neoplastic swellings were taken for histopathological examination at the time of surgery. In all cases wound coaptation was impossible even after undermining of the skin around the wound circumference.

Ulcerated mastocytoma and cutaneous fibroma and fibropapilloma as well as the unhealed ulcers were excised through an elliptical skin incision at the healthy margin away from the lesion. In all cases prior to the use of relaxing incision technique or the sliding flap technique; undermining of the skin around the wound circumference was performed first to a sufficient size as a trial to appose the wound edges.

Punctate relaxing incision technique was applied in five donkeys as described by Bailey *et al.* (1986). The incisions were started one cm away from the wound edge, 1cm long, and 0.5 cm apart in staggered parallel rows in both sides of the wound.

Z-plasty was applied in two donkeys affected with unhealed ulcers at the upper flank and chest wall regions respectively. The Z-shaped skin incision was made as described by Pavletic (1993) and started about 2 to 3 cm away from the lesion and the limbs of the Z were equal to the width of the lesion. The angles between the central limb of the Z and the arms were ranged from 50° to 60°.

For excision of fibrous band that was tying up both jaws in a Holstein dairy cow; a V-Y plastic incision was performed as the method described by Swaim, and Ralph, (1997).

In all cases a few simple interrupted sutures were placed under the advanced tissues to help close dead space. After final skin plastic repair evaluation at 24 – to 48 hours intervals often continue throughout the entire treatment period.

* Xylaject; 2% Xylazine hydrochloride: ADWIA, 10th of Ramadan City, Egypt. ** Debocaine: 2% lidocaine Hydrochloride: El-Nasr Pham.Chem.CO; for Al-Debeiky Pharma, ARE.

RESULTS

Punctate relaxing incision technique was used for skin wound closure of five donkeys. After excision of a soft fibroma at the lateral and anterior-medial aspect of hock joint in four and six years she donkeys respectively and a fibropapilloma in front of the scapula at left side of the neck in a 7 years old donkey (Fig. 1). The same technique was used also after excision of an ulcerated mastocytoma ulcer and granulating ulcer near the medial canthus of the left eye in a 4 years and 5 years old donkey respectively (Fig. 2). All the lesions were suffered from retarded healing and surgically excised through an elliptical skin incision that extended deeper enough to remove all the infected tissues specially in the case of ulcerated mastocytoma. In such case the lesion was deep and penetrated the nasal cavity; so a rubber drainage tube was fixed to the upper wound lip for flushing and drainages through the nasal opening (Fig. 4 A). The punctate incisions were started about one cm away from the wound edge, 1cm long, and 0.5 cm apart in staggered parallel rows in both sides of the wound (Fig. 3 B). The first row of relaxing incisions was done first and if coaptation failed a second one had been done. A continuous No-0 absorbable intradermal suture is used for closure first (Fig. 3 B&C). The skin is closed with a simple interrupted No-3 non-absorbable skin sutures (Fig. 3 D). The healing process was excellent in three cases from the operated animals. First intention healing took place two weeks postoperatively (Fig. 4 B) and the growing hair nearly covered the operated areas eight weeks later (Fig. 4 C). In case of the two donkeys which operated for fibroma excision from the lateral and anterior-medial aspects of the hock region; disruption of stitches was observed one week postoperatively. The stitches were removed and an immobilization bandage was applied after each dressing and the wound left to heal by second intention (Fig. 4D).

Z-plastic relaxing incision was performed for wound closure after excision of two weeks ulcers at the left flank region (Fig. 5 A) and the left upper part of the chest (Fig. 5 B) of 4 and 5 years old donkeys respectively. Both ulcers were persisted for more than 6 months and didn't respond to topical antiseptics and antibiotics therapy. Surgical excision was performed through an elliptical skin incision that included the weeks rim of the ulcer (Fig. 5 C). The resulted skin defect was closed through a Z-plasty incision that was formed from a central limb, two arms, and two angles where the arms join the central limb. The angles between the arms and central limb was ranged between 50 and 60° and

all arms were of equal length and nearly equal to the width of the skin defect (Fig. 5 D). After undermining the skin between the Z incision and the lesion it was advanced over the defect, and underlying tacking sutures of No-0 absorbable suture was used to close dead space (Fig. 6A). The tips of the Z-skin flap was sutured first with No-3 nonabsorbable half-buried horizontal mattress sutures then the rest of the Z-plasty defect was fixed into their new position with No-3 nonabsorbable simple interrupted sutures (Fig. 6 B). First intension healing was satisfactory in all cases (Fig. 6 C) and all wounded areas restore cosmetic skin appearance and the growing hair nearly covers the scar formation within eight weeks postoperatively (Fig. 6 D).

V-Y plasty was performed as relaxing technique for removal of a fibrous band that was encircling both jaws in a Holstein dairy cow. The cow was subjected to severe attack of dermatitis of unknown cause that affect most skin of the face (Fig. 7 A). The cow was treated locally and systemically with antibiotics and anti-inflammatory drugs. Eight months latter the cow was unable to open her mouth as a result of the formation of a deep fibrous band that was encircling and tying up both jaws (Fig. 7 B). A bilateral V-shaped skin incisions were made over the area of fibrous tissue formation at the level of both angles of the oral commissures (Fig. 7 C). A mouth gag was used to help widening of the mouth cavity while undermining and dissection of all the fibrous tissues from the depth of the wound and its circumference. The resultant wound was bigger than the primary one and the V-skin flap was advanced upwardly leaving a wide wounded area not covered by skin (Fig. 7 D). The remaining defect was closed in the shape of Y using No-3 nonabsorbable simple interrupted skin apposition sutures. The operated cow started to open her mouth for prehension of green fodder soon after surgery (Fig. 7 E). Two weeks later first intension healing was achieved with minimal scar tissue formation (Fig. 7 F).

In all cases the treated animals were allowed to put in work one week after removal of skin suture. All wounded areas restore cosmetic skin appearance and the growing hair nearly covers the scar formation within eight weeks postoperatively.

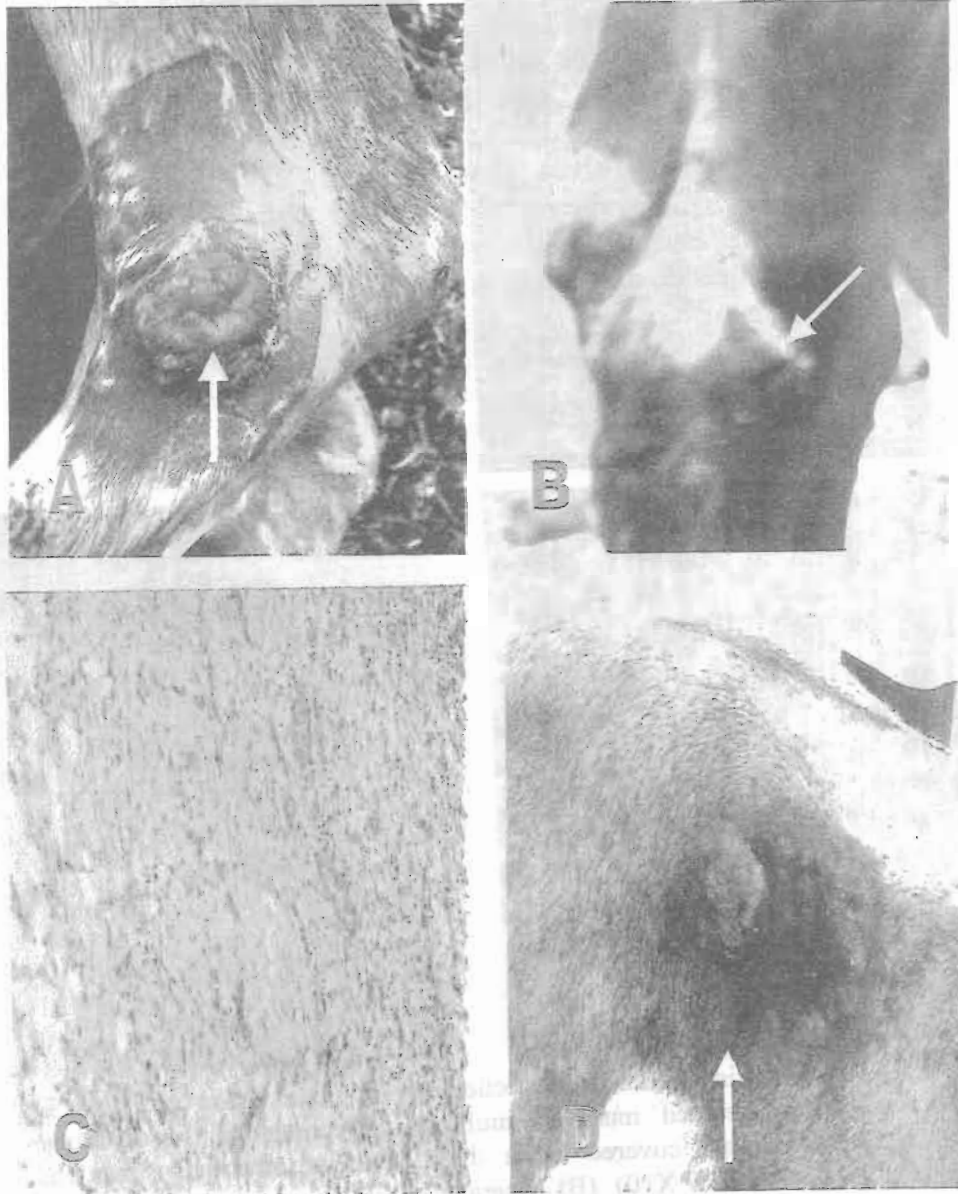


Fig. 1: Soft cutaneous fibroma at the lateral aspect of the left hock (A) and anterior-medial aspect of the right hock (B) in two different donkeys (arrows). (C) Histopathological section of the lesion reveals bundles of fibrous tissue proliferation. (D) Fibropapilloma at the left side of the neck just in front of the scapula in a 7 years old donkey (arrow).

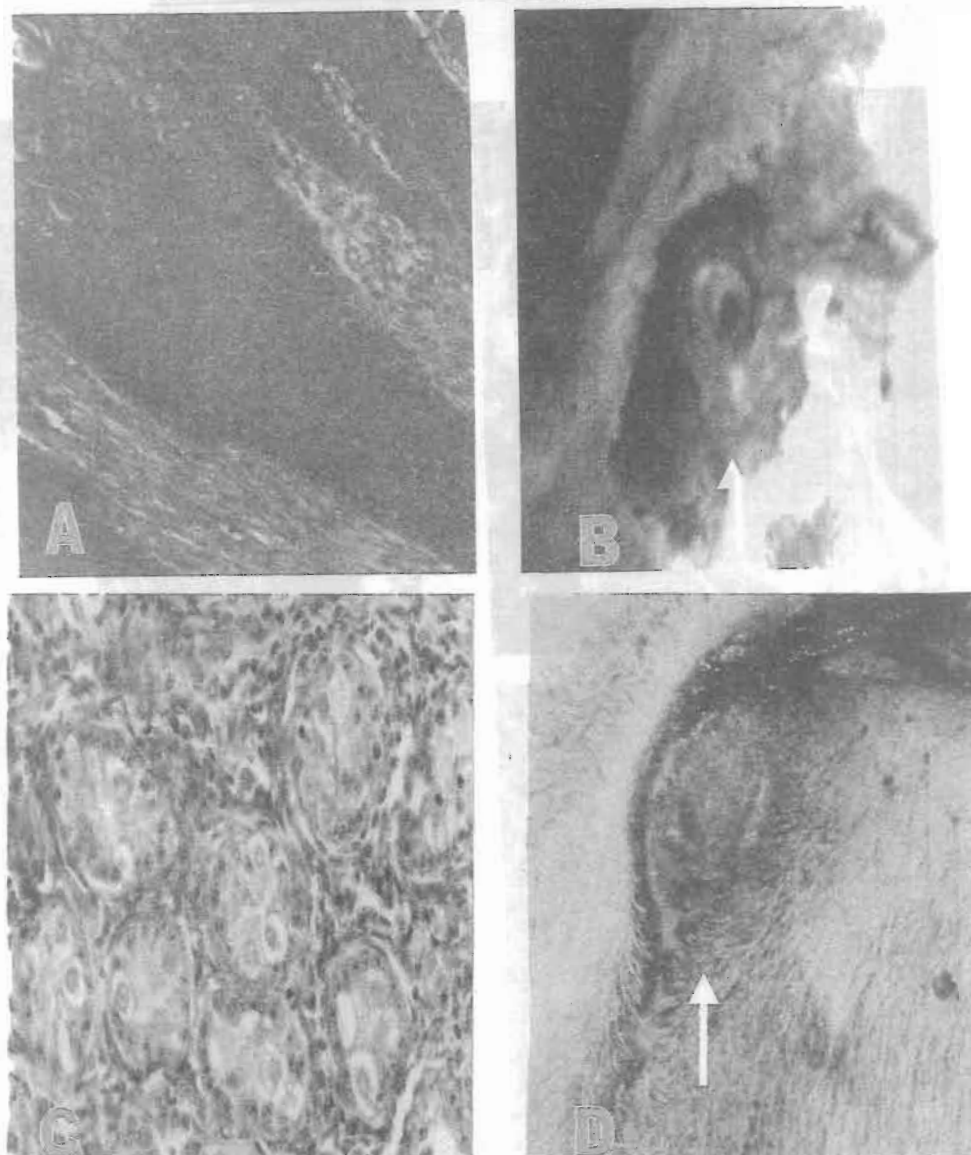


Fig. 2: (A) Histopathological section of the same lesion in Fig. 1 D reveals an elevated mass of multiple projections of fibrovascular connective tissue covered by a thick layer of stratified squamous epithelium (H & E X10). (B) Ulcerated mastocytoma at the left side of the face close to the medial canthus in a 4 years old donkey. (C) Histopathological section of the lesion reveals densely packed cords of round cells with central round nucleus, an abundant granular basophilic cytoplasm, and indistinct cell membrane. (D) Granulating unhealed ulcer at the left side of the face near the medial canthus of the eye in a 5 years old donkey (arrow).

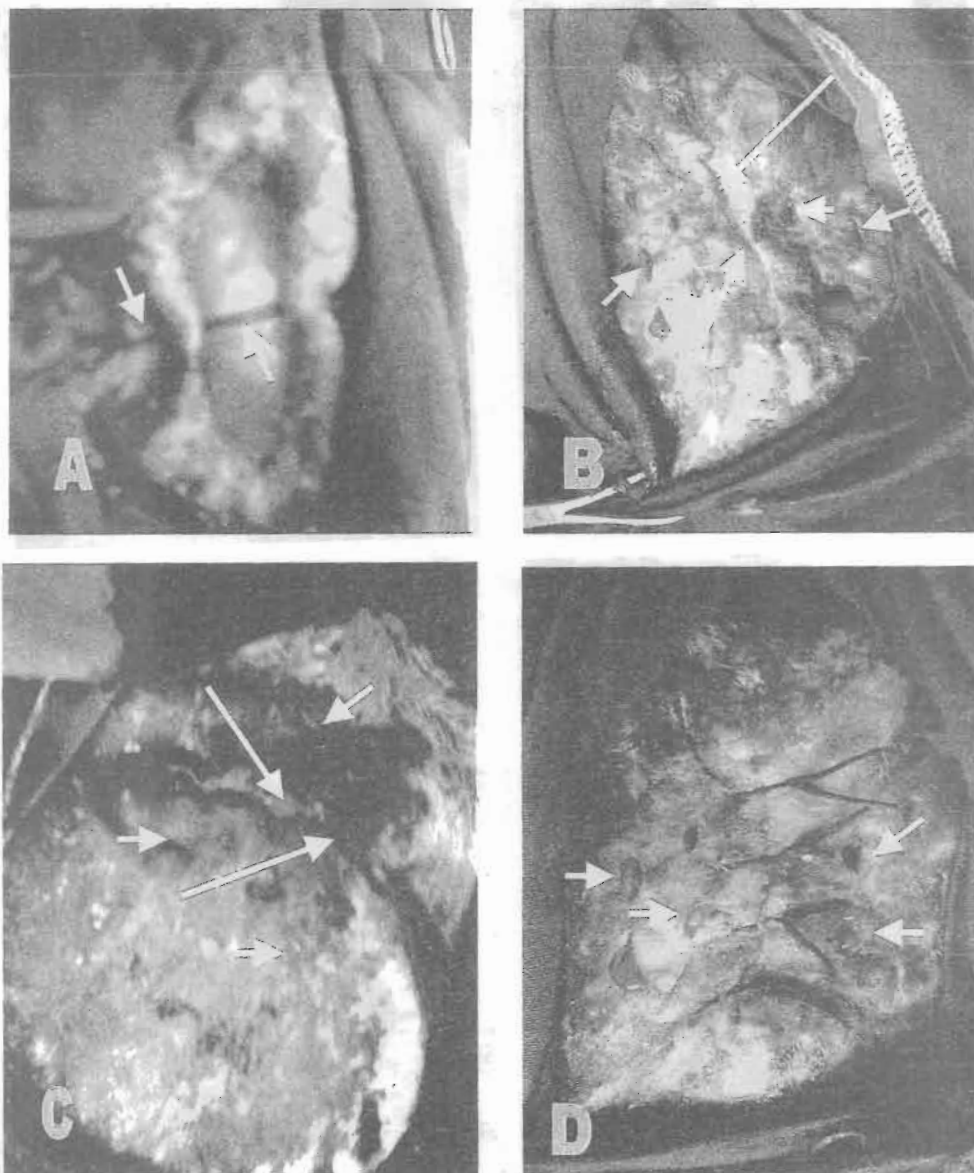


Fig. 3: (A) Left hock region showing a skin defect after excision of the tumor mass, undermining all its circumference and trials to appose wound edges using No-3 non-absorbable tension vertical mattress skin suture (arrows). (B) Left hock region and (C) left side of the face region; showing two rows of punctuate incisions made for relaxing the wound edges (short arrows). Notice the nearly apposed wound edges after placing a simple continuous intradermal suture (long arrow). (D) Final skin closure using simple interrupted No-3 silk sutures. Notice the skin expansion leads to widening of the punctuate incisions (arrows).

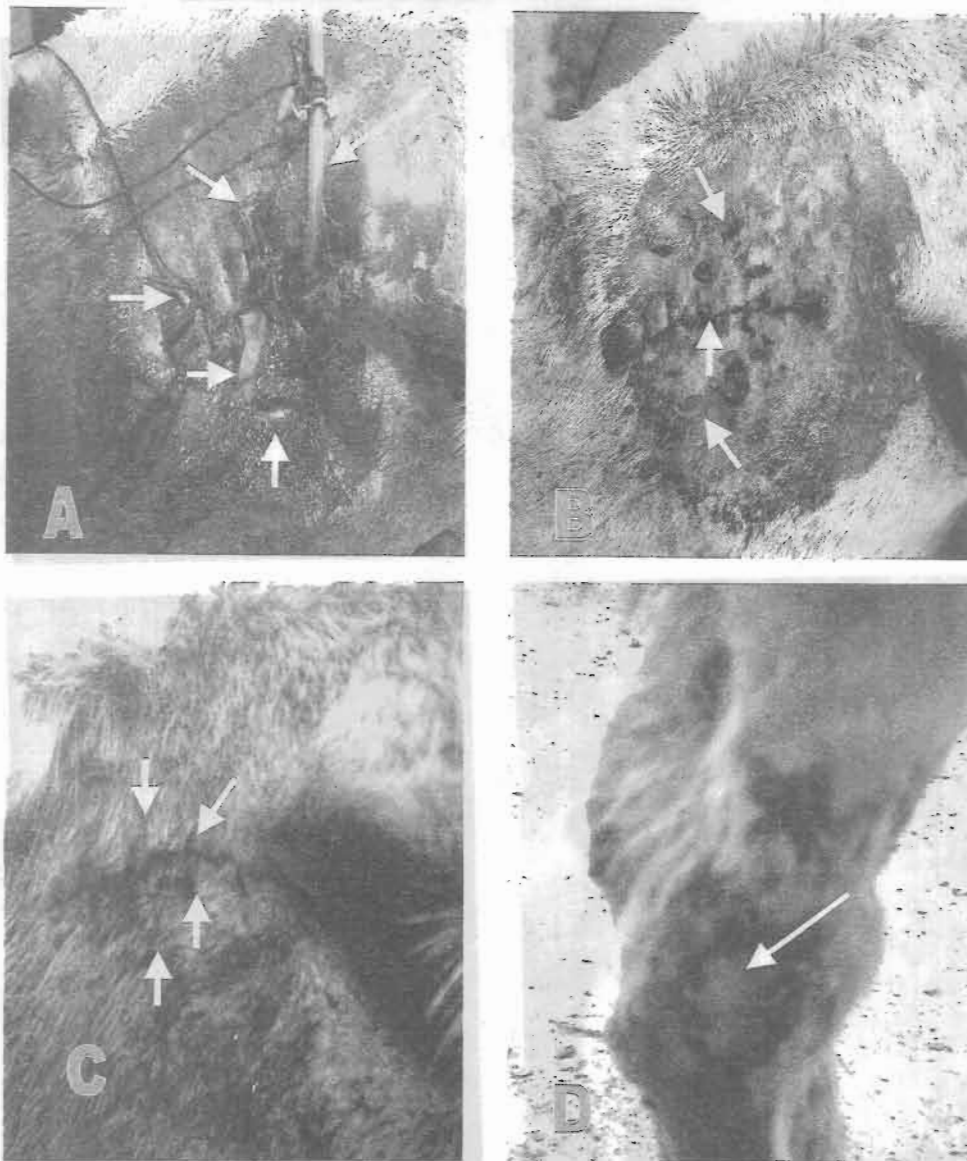


Fig. 4: (A) Final skin closure with simple interrupted sutures after excision of the ulcerated mastocytoma lesion. Notice the two rows of punctuate incisions made for relaxing the wound edges (short arrows) and the drainage tube fixed at the upper wound tip (long arrow). (B) The same case three weeks postoperatively showing first intension healing at the main incision site and scar tissue formation filling the areas of the punctuate incisions (arrows). (C) The same case after 8 weeks; notice the growing hair nearly cover all the formed scars (arrows). (D) Second intension healing process at the left hook region six weeks postoperatively (arrow).



Fig. 5: Z- plastic technique (A & B) unhealed ulcer at the lateral aspect of the flank region and chest wall in two donkeys respectively (arrows). (C) Skin defect after excision of the lesion and undermining its entire circumference (arrows) (D) Incision of the Z; notice that all limbs of the Z are of equal length and away from the primary lesion by 3 cm (arrows).

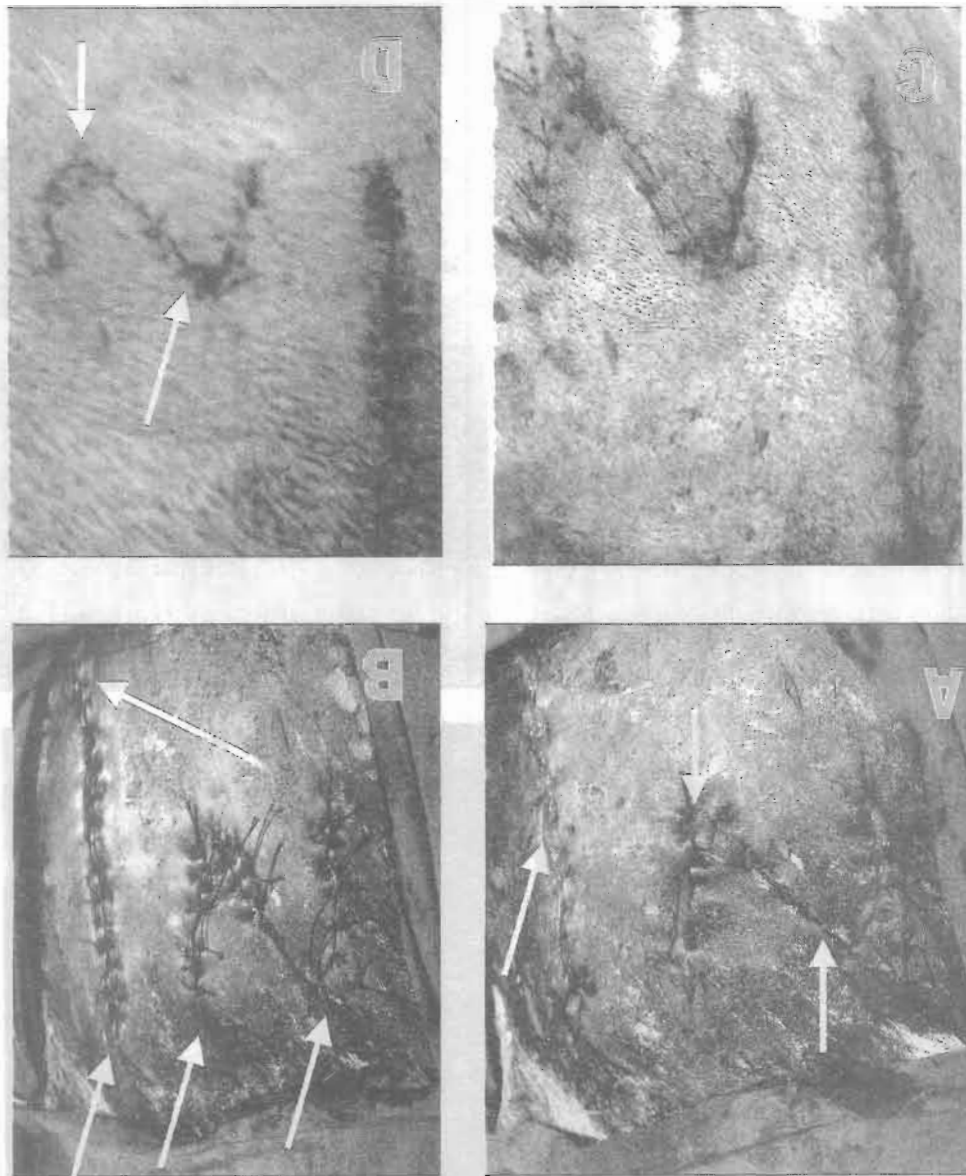


Fig. 6: (A) Transposition and fixation of Z flaps in their new position after placing of No-1 absorbable simple continuous intradermal suture and a half-buried No-2 non-absorbable horizontal mattress suture at flaps tip (arrows). (B) Final skin closure with simple interrupted sutures. Notice the good apposition of all wound edges without puckering of the wound ends (arrows). (C & D) First intension healing process of the same case two and four week's postoperatively. Notice the increase in the length of the central limb of the Z as a result of forward transposition of the Z-flap toward the original wound (arrows).

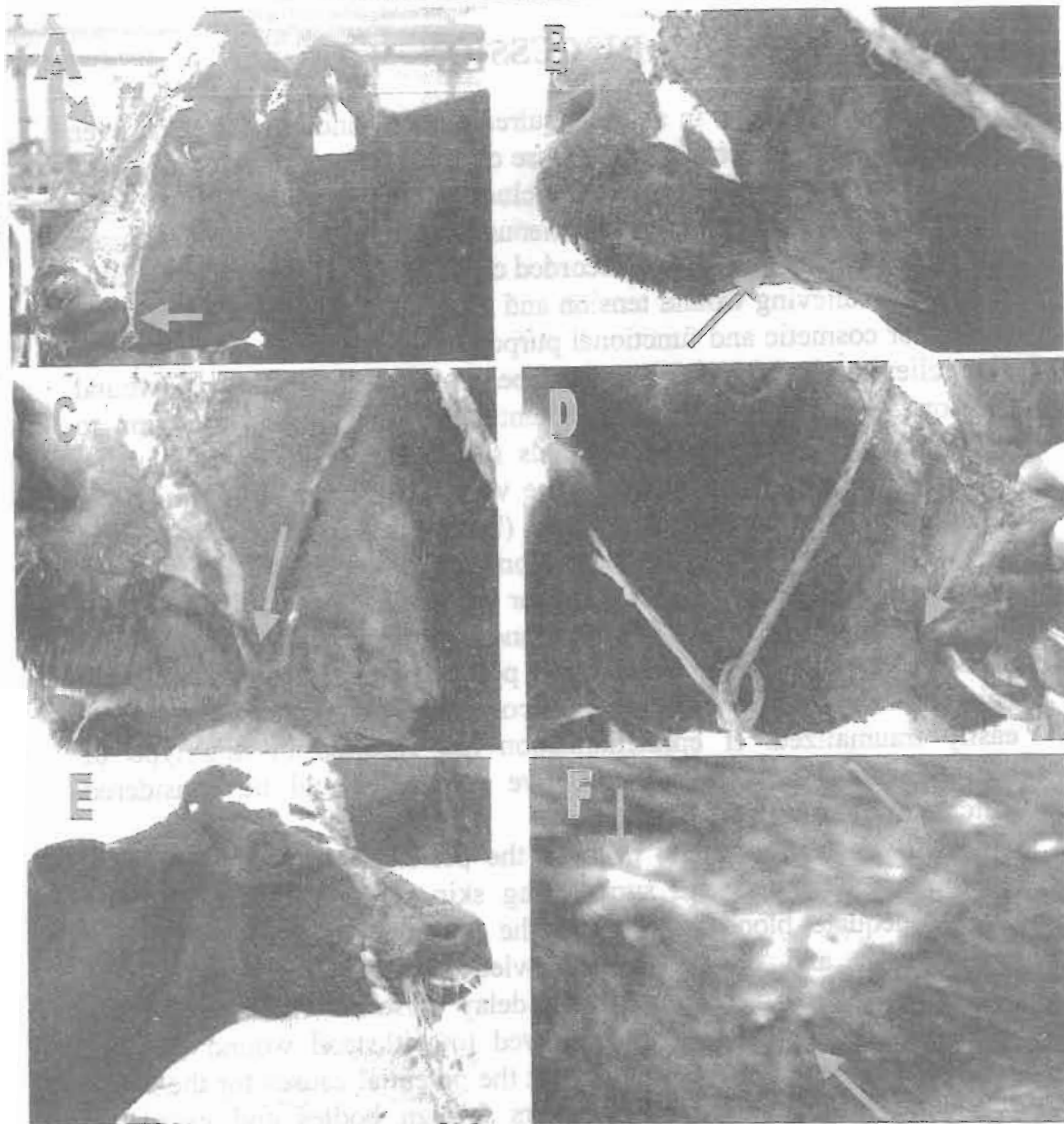


Fig. 7: V-Y plastic technique in a 7 years old cow with chronic eczema. (A) The scars appear at the face and mouth commissure (arrow). (B) A fibrous band encircling the oral commissure (arrows). (C) V-shaped incision is made through the skin over the fibrous band. (D) Dissection and undermining of the margins of the V incision as well as widening of the oral cavity with a mouth gag leads to upward transposition of the V skin flap (arrow). (E) Final skin sutures in a Y-pattern using No-3 non-absorbable simple interrupted suture and a stint bandage is applied to the free ends of the suture material. Notice the cow is able to open its mouth cavity soon after surgery. (F) The healing process of the wound in a Y-Pattern two weeks postoperatively after removal of sutures (arrows).

DISCUSSION

Undue tension in some acquired skin wounds may persist even after purposeful undermining. In these cases, additional tension relieving measures may be contemplated, including relaxing incisions or other plastic techniques. The three cutaneous reconstructive techniques used for skin wound closure in the recorded cases were proved to be a suitable means for relieving wound tension and allow wound healing by primary union for cosmetic and functional purposes. The selection of the type of the relieving incision is usually depends upon the extent of wound tension and the presence of sufficient skin in all wound direction to allow the needed extension. Wounds should be closed without undue tension to preserve circulation to the wound margin and minimize the occurrence of traumatic dehiscence (Swaim 1980 and Abou-El-Ella 2005). Recognition of excessive tension requires experience, as does the successful application of methods for its management (Myers 1965). When there is insufficient skin surrounding a wound to allow complete healing by contraction, the central portion of the wound heals by epithelialization. The result is an uncosmetic scar that is delicate and easily traumatized. If epithelialization has resulted in this type of healing, some form of reconstructive surgery should be considered (Fitch and Swaim 1995).

In all treated cases; prior to the performance of any relaxing technique the wound and surrounding skin areas were evaluated to assure adequate blood supply and the presence of enough skin for transposition and advancement. Pavletic (1986) and Swaim and Henderson (1990) recommended the delay of some wound apposition after the skin circulation has improved to withstand wound closure. Hendrix and Baxter (2005) advice that the potential causes for the delay of wound healing such as sequesters foreign bodies and excessive motion should be determined and removed to permit complete wound resolution.

The wounded areas in the treated cases were located in different body areas such as; the limb, close to the medial canthus of the eye, close to the mouth commissaries and at the lateral aspect of the body wall. The healing processes at these areas were retarded as a result of excessive mobility or mechanical interferences. The retardation of the healing process was attributed to excessive granulation tissue and infections in case of distal extremity wounds and ulcers (Blackford *et al.*, 1991), heavy load and bad quality saddle in case of back wounds in

donkeys (Koriem 2001), and reactive process in case of mastocytoma (London *et al.* 2001). Reconstructive and grafting techniques were indicated by Jacobs, *et al.* (1984) to overcome the slower and complicated healing of the skin lesions of the limbs.

The punctate relaxing incisions were used in areas having a minimal skin allowed for wound covering as close to the medial canthus of the eye or at the lateral and anterior-medial aspects of the hock region. So that the length of the punctate incisions used was not exceeded one cm to allow maximum skin elasticity for coverage and minimize the size of the resulted scars. The same finding was also noticed by Vig (1985) and Bailey *et al.* (1986) and they recommended the breaking up of the large relaxing incision into many small incisions for more cosmetic appearance and faster healing.

A single row of punctate incisions one each side of the wound margins was done first; then the wound was evaluated for presence of tension. If undue tension persists another rows were performed as needed to minimize vascular compression. Swaim (1990) and (1993); Swaim and Henderson (1990); Swaim and Scardino (1993); and Pavletic (1993) find that the chance of damaging the skin vasculature and causing necrosis are increased when more punctate incisions made than necessary.

The healing process after application of the relaxing incision was superb at the face and neck region while, stitches were pulled out through the tissues at the hock regions one week postoperatively. The stitches were removed and the wound left to heal by second intension with application of an immobilization bandage but excessive scar was observed at the center of the wound. The same complication was observed by Jacobs *et al.* (1984) and he attributed the scar formation to the absence of the cutaneous musculature underlying the integument in the limbs, which affords the skin considerable mobility. This mobility contributes to impressive second intension healing with minimal scarring in the upper body of the horse than in the limbs. Houlton and Edwards (1995) attempted suturing of wounds even in cases where sloughing is anticipated. They explained that in such cases an inevitable limited amount of primary union will take place, leaving less tissue to heal by granulation.

The Z-plasty technique was found suitable to be used at the lateral aspect of the body wall after excisions of weak ulcers from the upper flank and chest areas as there were enough skin permits the flaps of the Z-plasty to be transposed and lie in their new position. Swaim

(1980) and (1993) and Vig MM (1992) advised the surgeon to manipulate the skin around the wound to ensure that there will be sufficient skin in one direction to allow the needed relaxation in the perpendicular direction before using a Z-plasty as a relaxing incision.

All the limbs of the Z-plasty were of equal length as mentioned by Swaim, and Ralph (1997), while the angles between the arms and central limbs were approximately ranged from 50 to 60°. The central arm after final wound closure was rounded and elongated toward the original wound as mentioned by Swaim and Ralph, (1997) and Pavletic (1993).

The V-to- Y plasty technique was helpful for relieving fibrous tissue adhesion that was encircling both jaws of a Holstein dairy cow. Although the operated cow was not able to open its mouth as in normal range but she was able to feed green fodders normally. Hickman (1995) indicated the use of the same technique for relieving minor tension in small areas.

From the present study we can concluded that the use of mesh expansion technique "punctate relaxing incisions" and sliding flap techniques "Z and V-Y plastic incisions" not only avoids the undue lengthy process of healing by granulation but also the subsequent unsightly scarring. The enhancement of the healing process was attributed by Bennett (1988) and Fitch and Swaim (1995) to the occlusion of the wound that improves humidity and preventing formation of a scab and increases the rate of epithelialization. Moreover, the scars lifted after application of the relaxing incisions in the recorded cases were small and nearly covered by the growing hair within eight weeks. Houlton and Edwards (1995) explained that second intension healing of wide skin wounds are often leave a wide scar, devoid of hair, which gradually contracts giving rise to unhealthy contraction lines. Bailey, *et al.* (1986) attributed the considerable success of the relaxing incisions in the horse than in human to the hair coverage of the horse usually conceals most associated scars.

Veterinary practitioners should be familiar with these least invasive reconstructive and effective skin relaxing incisions to allow complete wound healing after excision of some cutaneous tumors, unhealed large ulcers, and relieving wound tension to allow primary union healing.

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