

Effect of *Equisetum arvense* on Wound Contraction of Full-Thickness Skin Wounds in Rabbits

¹A. Hayat, ²F. Temamogullari, ³R. Yilmaz and ⁴O. Karabulut

¹Department of Surgery, ²Department of Pharmacology,

³Department of Pathology, ⁴Department of Biometry,

Faculty of Veterinary Medicine, Harran University, Sanliurfa, Turkey

Abstract: The effect of *Equisetum Arvense* (EA) on wound healing in rabbits was investigated and compared to commonly used povidone iodine and sodium chloride. Twelve rabbits were used as material. A total of 36 full-thickness skin wounds 3 from each of 12 rabbits were created on their dorsal aspect. Postoperatively, the wound surfaces were macroscopically examined and the effects of different shapes and sites of wound on the healing process and the rates of wound expansion, contraction and epithelization. Biopsy specimens that were collected on the 4, 7, 10 and 14th Postoperative Days (PODs) were evaluated according to several histopathologic parameters such as the neutrophil, macrophage infiltration, fibroblast and fibrocytes.

Key words: *Equisetum arvense*, wound contraction, rabbits, biopsy specimens, Turkey

INTRODUCTION

Wounds include cuts, scrapes, scratches and punctured skin. They often occur as a result of an accident or injury but surgical incisions, sutures and stitches also cause wounds. Wound healing is a complex and dynamic process of restoring cellular structures and tissue layers. There are basically 4 phases to the healing process: inflammatory phase, proliferative phase (Collagen), remodeling phase, epithelization. Healing is a response to the injury that sets into motion a sequence of events. With the exception of bone, all tissues heal with some scarring. The object of proper care is to minimize the possibility of infection and scarring.

Clinicians has used numerous strategies to combat wound infections in cluding topical and systemic administration of antibiotics and various antiseptic agents (Willats *et al.*, 1995). The ideal result is rapid regeneration, leading to the perfect restoration of form and function that may result in certain undesirable complications including keloid formations, a poor final cosmetic appearance and the formation of fragile epithelial layer (Kilic *et al.*, 2002; Hayat *et al.*, 2009).

The genus *Equisetum* (Equisetaceae) is diversely distributed in Anatolia and is represented by seven species (*Equisetum palustre* L., *Equisetum hyemale* L., *Equisetum arvense* L., *Equisetum telmateia* Ehrh., *Equisetum ramosissimum* Desf., *Equisetum sylvaticum* L. and *Equisetum fluviatile* L.) in total in the Turkish flora (Gurbuz *et al.*, 2009). These species are used for a wide range of therapeutic purposes in Turkish folk medicine

and other country for such as Italy and Canada particularly against urinary problems such as passing kidney stones/or sand, pyelonephritis, prostatitis, cystitis, etc. possibly due to their remarkable diuretic activity. In addition, various other utilizations reported in ethnobotanical surveys on Turkish folk medicine which include usage against gastrointestinal disorders (stomachache and peptic ulcer, hemorrhoids); rheumatic pain, pain in former broken bones, gall bladder inflammation, haemostatic, jaundice, hepatitis, eczema and acne also against various types of infectious diseases such as fungal or apthous infections and bronchitis as expectorant in cough and against cardiac deficiencies particularly of arteriosclerosis and due to its rich silicate content to strengthen hair, skin or nails (Yesilada *et al.*, 1995, 1999; Tuzlaci and Tolon, 2000; Tuzlaci and Aymaz, 2001; Novais *et al.*, 2004; Pieroni *et al.*, 2004; Oh *et al.*, 2004; Uzun *et al.*, 2004; Kultur, 2007; Ugurlu and Secmen, 2007; Gurbuz *et al.*, 2009; Temamogullari *et al.*, 2009).

The aerial parts of E.A. have been used for gastrointestinal disorders in ruminant and diuretic in pet (Viegi *et al.*, 2003; Lans *et al.*, 2007; Cornara *et al.*, 2009). E.A. has hypoglycaemic and diuretic activity. The hydroalcoholic extract of stems of E.A. produced an antinociceptive effect and anti-inflammatory activity linked to beta-sitosterol (Lans *et al.*, 2006). Also, it is astringent acts as diuretic on genito-urinary system; controls both internal and external bleeding.

In this study, we have investigated efficacy of of 5% E.A. on wound healing, comparing with 10% povidone iodine and 0.9% sodium chloride.

MATERIALS AND METHODS

This study was conducted in accordance with the Harran University Animal Experimentation Local Ethics Committee for protection of animals used for experimental and other scientific purposes.

Six male and six female rabbits weighing about 2500±200 g were taken for the study. The dorsal aspects (backs) of rabbits were clipped and prepared for aseptic surgery. All rabbits were anesthetized with i.m. administrations of 10 mg kg⁻¹ xylazine hydrochloride (Rompun, Bayer) and 50 mg kg⁻¹ ketamine hydrochloride (Ketanes, Albe). On dorsal aspect of each animal, two cranially and one caudally located full-thickness skin wounds in 3.14 cm diameter were created using a template prepared from an X-ray film.

Following incision, different wounds of each animal were treated with 5% E.A. To prepare equisetum arvense extract, the leaves of equisetum arvense were cleaned with water then 5 g of cleaned and crashed leaves was heated until boiling in a container of 100 mL distilled water and then filtered through a piece of double layered muslin cloth, 10% povidone iodine (Biokadin, Biokan, Turkey) and 0.9% sodium chloride (Izotonik Sodyum Klorur, I.E. Ulagay, Turkey) with gauze saturated applied to the defects occurred experimentally. Then the wounds were closed with sterile gauze and fixed with circular adhesive bands. The animals had free access to water and standard laboratory pellet and were housed individually to prevent them from tampering with the other wounds. The dressings were changed every other day until complete wound healing.

During the postoperative period, all rabbits were checked daily for general health condition, bandage slippage and other unspecified abnormalities. Wounds surfaces were macroscopically examined from the points of exudation, bleeding and epithelization during the postoperative period. Wound diameter was measured with calliper both horizontally and vertically and the average received in postoperative 4, 7, 10 and 14th days. Biopsy specimens that were collected on the 4, 7, 10 and 14th Postoperative Days (PODs) were evaluated according to several histopathologic parameters such as the neutrophil, macrophage infiltration, fibroblast and fibrocytes. Statistical analyses were performed by using statistical analysis system configured for computer (SPSS, Release 11.0, SPSS, Inc). Parameters were evaluated using variance analysis and Tukey test.

RESULTS AND DISCUSSION

All rabbits survived until the end of the study with no sign of pain or discomfort. The epithelization was completed on POD 14 on 5% E.A. and 10% povidone

Table 1: The wound contraction in the groups (mm) (mean±SE)

| Groups | Day 4 | Day 7 | Day 10 | Day 14 |
|----------------------|------------|------------|------------|-----------|
| 5% Equisetum Arvense | 22.63±0.99 | 17.63±1.40 | 15.30±2.33 | 4.00±0.61 |
| 10% Povidone Iodine | 24.63±0.99 | 20.38±0.66 | 18.00±1.21 | 0.10±0.78 |
| 0.9% Sodium Chloride | 25.38±1.31 | 22.63±1.33 | 17.4±0.83 | 1.62±1.64 |
| p-value | NS | * | NS | ** |

*:p<0.05; **:p<0.01; NS:Non Significant

iodine gauze-applied wounds whereas it wasn't completed on 0.9% sodium chloride gauze-applied wounds and ulceration in central wounds was seen.

Effects of 5% E.A. on wound contraction of full-thickness skin wounds in rabbits are shown in Table 1. Differences in postoperative 4th days and postoperative 14th days were significant but 7th and 14th day was nonsignificant. But in postoperative 4, 7, 10 and 14 days, differences between the neutrophil, macrophage infiltration, fibroblast and fibrocytes were nonsignificant. Plants have been used for medicinal purposes for as long as history has been recorded. E.A. benefits are numerous. It has antiseptic, antibacterial, astringent qualities. It helps the body to fight infection.

The silica content in the E.A. helps the body absorb and use calcium. Its silica and silicic acid content strengthens weak connective tissues. The silica present in the extract promotes the absorption of calcium by the body which is important for tissue repair as well as bone formation. Silicon in the E.A. promotes collagen production which is highly beneficial in maintaining the elasticity of skin. It is only known to be an effective cure for premature aging but also heals skin conditions like acne and eczema. Saponins in E.A. which stimulates metabolism and have anti-inflammatory properties (Sybil, 2010).

As a result 5% E.A. is more effective when compared to other other solutions. Application of 5% E.A. to full-thickness skin defects in rabbits accelerated occurrence of wound contraction. The positive effect on wound contraction may have resulted from silica, silicic acid, silicon and saponins in the E.A.

CONCLUSION

In this study, E.A. has more effective on wound contraction of full-thickness skin wounds in rabbits when compared to other solutions.

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