International Surgery Journal
Kochar MP et al. Int Surg J. 2015 Aug;2(3):369-372
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20150501

Research Article

Incised surgical wound closure with sutures and staples: a controlled experimental study

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Received: 02 June 2015
Revised: 09 June 2015
Accepted: 11 July 2015

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ABSTRACT

Background: Development of newer techniques of surgical wound closure which are not associated with contamination. Aim is to evaluate advantages and disadvantages of skin closure with sutures and staples.
Methods: A controlled experimental study was conducted on guinea pigs divided into two groups of 10 each in NIMS Medical College, Jaipur, in the year 2013. On 5th POD signs of inflammation (redness, oedema), discharge (serous/seropurulent/purulent), dehiscence (partial or complete) was assessed. On 15th POD sutures and staples were removed and a strip of scar tissue excised for measurement of tensile strength and histopathology of each wound.
Results: Average time taken to close a wound in group 'A' 92.8 sec and in group 'B' 30.3 sec, in group 'A' two showed redness, one swelling & one serous discharge, in group 'B' one redness, two swelling and one serous discharge, tensile strength in group 'A' was 429.9 grams and in group 'B' 393.6 grams., average cost per wound closure was negligible in group 'A' whereas in group 'B' it was Rs. 160/-. There is paucity of literature correlating tensile strength of the healed wound in relation to histopathology of scar tissue. The results were very encouraging, that in group 'A' fibroblastic proliferation and collagination was +++, in group 'B' it was ++ & + respectively.
Conclusions: Wound closure with staples is almost three times faster thus time saving but less tensile strength of scar tissue than with sutures.

Keywords: Incised surgical wound closure, Sutures, staples, Guinea pigs, Tensile strength, Histopathology

INTRODUCTION

Skin can be approximated with various absorbable and non-absorbable sutures, results depends on the technique and suture material used. Stainless steel staples are virtually inert so as to cause minimal tissue reaction, rectangular shape design minimizes tissue trauma, apposition by stapling minimizes tissue compression, space between staple crown and skin surface minimizes cross hatching, hence superior cosmetic results and easy staple removal.[1,2] A controlled experimental study was conducted to compare the advantages and disadvantages of incised surgical wound closure with sutures & staples.

METHODS

A controlled experimental study was conducted on guinea pigs divided into two groups of 10 each, group 'A' (sutures) and group 'B' (staples). Animals were kept fasting for 2hrs before the operation. Dorsal surface of each animal was shaved and washed thoroughly with savlon and painted with povidone-iodine lotion, weight of each animal was noted, halothane was used as anaesthetic agent because of ease and rapidity of induction and safety of animal.

Figure 1: Skin incision on shaved dorsal surface of guinea pig upto deep fascia.

Figure 2: Staples application.

Figure 3: Sutured wound.

Figure 4: Stapled wound.

A single longitudinal skin incision deep till deep fascia was created. Each wound was closed with plain interrupted silk sutures in group 'A' and with staples in group 'B' after achieving haemostasis. All wounds were closed by a single operator to get uniform results. Time taken for skin approximation was measured by an independent observer, wounds after cleaning with povidone-iodine lotion dry gauge dressing applied and covered with adhesive plaster to avoid damage to dressing by self or by other animals. Animals were kept in group of five in different cages. On 5th POD signs of inflammation (redness, oedema), discharge (serous, seropurulent, purulent), dehiscence (partial, complete) was assessed.

Figure 5: Sutured wound-length measurement on 15th POD.

Figure 6: Stapled wound-length measurement on 15th POD.

On 15th POD again after anaesthetising the guinea pigs sutures and staples removed, wound length measured and a strip of scar tissue excised from each wound and tensile strength measured by tensilometer. Wound thus created was again closed, dressed and guinea pigs returned to their cages. A block of scar tissue send for histopathology to see - fibroblast with their maturity stages, fibrocytes and their intermediate stages, neovascularisation, collagination, inflammatory cell type and quantity, inflammatory oedema, epithelialisation, gram's staining for bacterias etc.

Table 1: Relation of wound length with closure time and cost.

	Sutures	Staples
Average wound length	7.32	7.5
Time taken/wound	92.8	30.3
Time taken/cm wound	12.67	4.04
No. of sutures/staples/wound	7.4	8.1
Time taken/suture or staple	12.54	3.74
Average cost/ wound	Negligible	160/-

Length in cm, Time in sec, Cost in rupees

Table 2: Incidence of inflammation, discharge and dehiscence.

	Sutures		Staples	
	No.	%	No.	%
Signs of inflammation				
Redness	2	20	1	10
Swelling	1	10	2	20
Discharge				
Serous	1	10	1	10
Seropurulent	-	-	-	-
Purulent	-	-	-	-
Dehiscence				
Partial	-	-	-	-
Complete	-	-	-	-

DISCUSSION

Guinea pigs weight ranging between 400-800 grams, average wound length in group 'A' 7.32 cm and in group 'B' 7.5 cm and average time taken 92.8 sec and 30.3 sec respectively i.e. stapling was three times faster than sutures.[1-4] In group 'A' two had redness, one swelling and one serous discharge, group 'B' one redness, two swelling and one serous discharge, wound dehiscence was zero in both groups.[1,3,5] Average cost to close a wound in group 'B' was Rs. 160/- whereas in group 'A' negligible.[2,6]

Figure 7: Sutured wound-length measurement on 15th POD.

Figure 8: Stapled wound-length measurement on 15th POD.

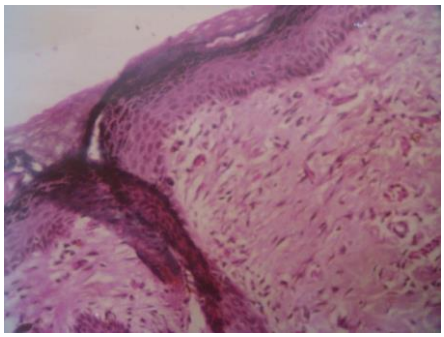

Figure 9: Squamous epithelium, subepithelial fibroblastic proliferation, neovascularisation. H&E 10x45X.

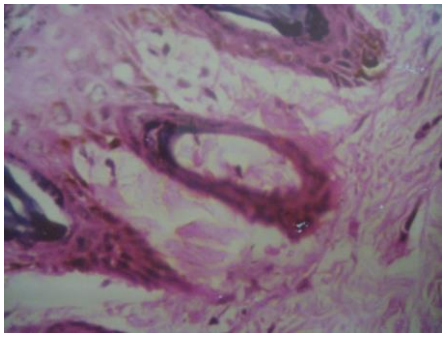

Figure 10: Squamous epithelium, subepithelial collagination. H&E 10x10X.

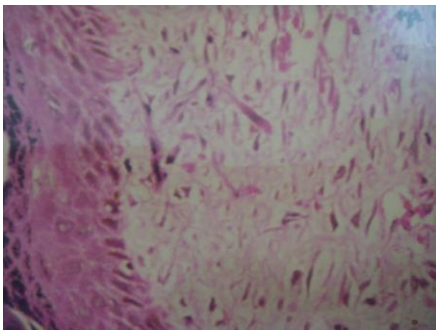

Figure 11: Squamous epithelium, subepithelial fibroblastic proliferation (intermediate variety) H&E 10x45X.

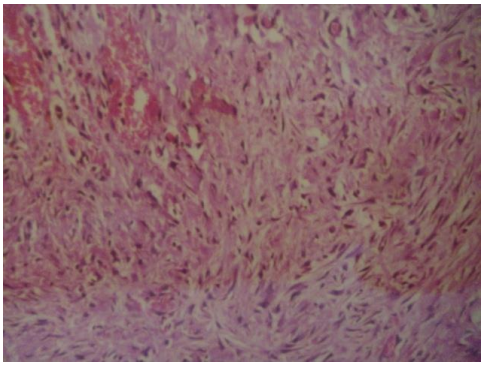

Figure 12: Fibroblastic proliferation, neovascularisation. H&E 10x10X.

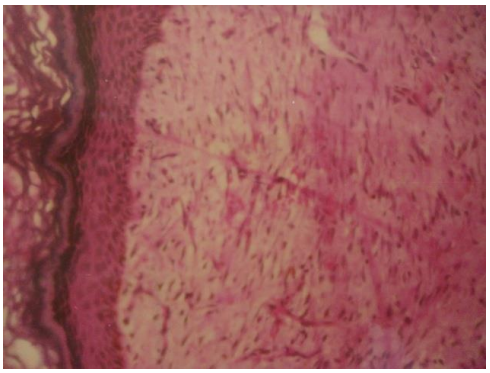

Figure 13: Hyper-keratotic squamous epithelium, subepithelial oedema, fibroblastic proliferation, H&E 10x10X.

Table 3: Relation of tensile strength with histopathology of scar tissue.

	Sutures	Staples
Tensile strength	429.9 gm	393.6 gm
Histopathology		
Fibroblast with their maturity stages	+++	++
Fibrocytes and their intermediate stages	-	++
Neovascularization	+	++
Collagination	+++	++
Inflammatory cells types and quantity	-	-
Inflammatory oedema	-	-
Epithelialisation	++	+
Gram's staining for bacterias	-	-

Tensile strength of scar tissue at which wound break observed 429.9 grams in group 'A' and 393.6 grams in group 'B'. Bresnahan KA et al. observed higher tensile strength in sutured group,[7] in group 'A' fibroblastic proliferation & collagination was +++, in group 'B' it was ++ & + respectively, means fibroblastic proliferation and collagination was directly proportional to the tensile strength of scar tissue, Gram's staining in both the groups was negative.

CONCLUSION

In this study time taken to close a wound with staples was almost three times faster than with sutures, signs of inflammation were more or less equal and wound dehiscence was zero in both the groups.[1-5] Average cost per wound closure was very high with staples v/s sutures,[2,6] tensile strength[7] and fibroblastic proliferation and collagination observed higher with sutures v/s staples.

ACKNOWLEDGEMENTS

We would like to acknowledge department of Pharmacology and Pathology of our medical college.

Funding: The study was self-funded
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Kochar MP, Singh SP. Incised surgical wound closure with sutures and staples: a controlled experimental study. Int Surg J 2015;2:369-72.