

Research Article

Study of comparison between skin sutures and skin staplers: 400 case studies

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ABSTRACT

Background: There are various ways the skin approximation whether be it sutures, staplers, glues, sterile tapes all of these have the same purpose of but the one which provides the best scar with least wound infection and consumes least time is the one that should be used. So here we have studied 400 patients over a period of 20 months comparing skin sutures with staplers and their outcome with respect to time consumed and percentage of complication.

Methods: A prospective type of study was conducted from January 2013 to August 2014 at Dr. D Y Patil Hospital, Nerul for comparison between skin sutures and skin staplers in terms of effectiveness and complications in 400 patients who underwent various surgical procedures. The patients included in this study were randomly selected from those who underwent various surgical procedures which were either elective or emergency with various incisions.

Results: The average time taken for skin closure by staplers is 1.84 min per 10 cm of wound & for skin sutures, it is 6.61 min per 10 cm of wound and complication rate for suturing is 30% & for staplers it is about 12%.

Conclusion: Outcome of staplers is cosmetically superior to skin sutures with overall less complication as compared to skin sutures.

Keywords: Suturing, Staplers, Skin suture, Sutures

INTRODUCTION

Accurate tissue approximation is essential for operative repair of defects and execution of defects and execution of safe healing process. Aside from gentle handling of tissues and careful dissection, the approximation must be achieved without tension and without compromising the integrity of the blood supply which is essential for healing process. The perfectness of tissue approximation and type of approximation influences the tissue healing rate, postoperative early and late complication of surgical wound and economical burden of the hospital. Though the age's man sought for methods of binding wounds to promote healing. In olden days spider webs, warrior ants etc. were used till suture materials were discovered. In this modern era broadly speaking the materials or gadgets for approximation of tissues are the sutures, staples or

clips, glues, steritapes etc., the secret to achieve a good wound healing lies in meticulous tissue dissection selection of suture material, methods of wound closure and post-operative complications. The key principles involved to achieve perfect healing are preservation of blood supply, minimal tissue damage, approximation of edges without tension, correct Suture spacing and suture bites with proper selection of suture materials.

In conclusion the surgical technique is far more important than the sutures used but a good scientific knowledge of different sutures and needles and how they perform, will aid the surgeon to achieve optimum wound healing. Since suture technology has kept in pace with advances in surgical techniques, it is imperative on the part of the surgeon not only to be fully aware of them but also to keep them in their surgical armamentarium. Skin staplers

are far better for skin closure in terms of effectiveness, cost and in terms of compliance and complications. This study is conducted for comparison of skin closure by using skin sutures and skin staplers with respect to effectiveness and complications.

METHODS

This is a prospective type of comparison study conducted from January 2013 to August 2014 at Dr. D Y Patil Hospital, Nerul 400 patients who underwent various surgical procedures. The patients included in this study were randomly selected from those who underwent various surgical procedures including.

1. Elective.
2. Emergency procedures with various incisions.

The relevant data of patients included in the study were collected and recorded as follows. Age of the patient, sex, occupation, type of incision, length of incision, gadget used for skin closure, time taken for skin closure, post-operative complications namely wound infection, seroma formation, stitch abscess, stitch granuloma, wound gaping and adverse scars were observed for and recorded in the proforma. The post-operative day of suture removal was also observed. The final outcome of the scar whether good, fair or ugly was observed in the follow up period and recorded in the proforma.

Skin closure was done by using suture materials namely ethilon, prolene, nylon etc., and compared with staplers and the outcome were observed and recorded. The methods used for skin closure with suture materials were

simple, mattress and subcuticular sutures using various suture materials which are chosen based on the availability of suture materials in the operation theatre.

RESULTS

This study included total of 400 cases that underwent various surgical procedures at various site, various type of incision from the period of January 2013 to August 2014. Out of these 400 cases 200 cases underwent skin closure by sutures and 200 patients underwent skin closure by skin staplers.

Table 1: Showing % distribution of site of wounds.

Site of wound	No. of patients	Percentage
Head and neck	80	20%
Thorax.	80	20%
Abdomen and groin	160	40%
Upper and lower limbs	80	20%

The methods adopted for skin closure was chosen randomly in this study revealed that suture materials were used in 200 patients and staplers in 200 patients.

Table 2: Item used for skin closure.

Item used	No. of patients	Percentage
Suture	200	50%
Stapler	200	50%

Table 3: Outcome for skin sutures.

Site of the wound	Average length of wound	Type of suturing	Average speed of closure - minutes/10 cm wound	Materials used	% of complication
Head and neck	7.3 cm	Simple (for face) & vertical mattress (for scalp) & subcuticular (for neck)	8.04	Prolene was used for face and neck & ethilon for scalp	6
Chest wall	9.05 cm	Vertical mattress	3.5	Ethilon	6
Abdomen & groin	12.9 cm	Vertical mattress	8.52	Ethilon	14
Upper & lower limb	10.3 cm	Vertical mattress	6.23	Ethilon	4

Figure 1 shows the % distribution of complication rates among wounds closed with skin sutures.

Complications studied are wound gaping, wound infection, seroma formation, tissue reaction around the suture material, suture line necrosis, stitch abscess, granuloma and ugly scars.

Average length of wound and time of closure is nothing but the arithmetic mean obtained from the chart.

Calculation

Length of each wound and its time taken for closure using skin sutures is calibrated for length of 10 cm. Thus

the average time taken for closing 10 cm wound with skin sutures is $=\sum x/n = 6.61$ minutes.

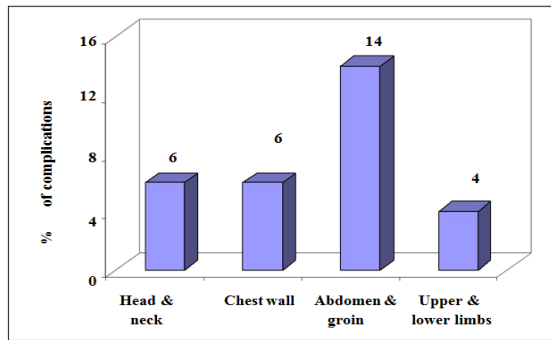


Figure 1: Shows the % distribution of complication rates among wounds closed with skin sutures.

Figure 2 showing % distribution of complication rates with skin staplers with respect to various sites.

Complications studied are wound gaping, wound infection, seroma formation, tissue reaction around the suture material, suture line necrosis, stitch abscess, granuloma and ugly scars.

Average length of wound and time of closure is nothing but the arithmetic mean obtained from the chart.

Calculation

Length of each wound and its time taken for closure by using is calibrated for length of 10cm. Thus the average time taken for closing 10cm wound with skin staplers $=\sum x/n = 1.84$ minutes.

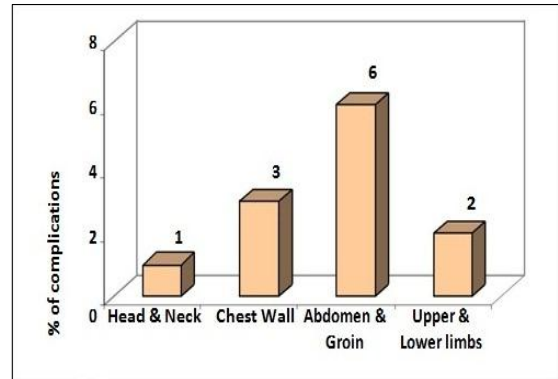


Figure 2: Showing % distribution of complication rates with skin staplers with respect to various sites.

Table 4: Outcome for staplers.

Site of the wound	Average length of wound	Type of suturing	Average speed of closure - minutes/10 cm wound.	Materials used	% of complication
Head and neck	7.62 cm	Staplers	1.74	Prolene for face and neck & silk for scalp	1
Chest wall	8.65 cm	Staplers	2.43	Ethilon	3
Abdomen & groin	9.80 cm	Staplers	1.65	Ethilon	6
Upper & lower limb	10.80 cm	Staplers	1.54	Ethilon	4

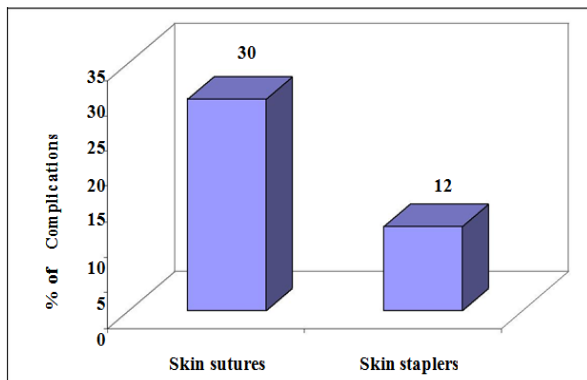


Figure 3: Percentage distribution of complications for sutures versus staplers.

Table 5: Comparison between sutures and staplers.

Items used	Average speed of closure in minutes per 10 cm wound	Compliance of patients and surgeon	Incidence of complications
Suture	6.61	Fair	30%
Stapler	1.84	Good	12%

By using the formula $\sum(O-E)^2/E$ the Chi-square value (X^2) is calculated as 9.76.

The degree of freedom for the above table is calculated by using the formula $(Column-1) \times (Row-1)$ and the value is 1. From probability distribution table the P value for the obtained values is as follows:

The value of Chi square for a probability of 0.05 is 3.84 which is less than the calculated value.

Table 6: Testing the significance (Using Null hypothesis).

Sr. No.	Number of patients with complication	No. of patients without complication	Total	Compliation rate
Sutures	60	140	200	30%
Staplers	24	176	200	12%
Total	84	316	400	

Also the value of Chi square for a probability of 0.005 is 7.88 which is less than calculated value. But, for the probability of 0.001 the Chi square value is 10.83 which is more than the actual value.

DISCUSSION

The use of mechanical means for wound closure first appeared in ancient Hindu medicine. Insect mandibles were employed for wound closure in the jungles of southern Bhutan at the foot of the Himalayas.¹ Victor Fischer, an ingenious designer of surgical instruments, was the inventor of the first surgical stapler that used metal staples.² He designed and developed different gastrointestinal staplers for Hümér Hütl, one of the leading surgeons at the St. Rokus Hospital in Budapest. In 1920, Aladár von Petz, a young surgical assistant at the University of Budapest, designed a stapler weighing only 1kg that became the prototype for future GI staplers. Subsequently, a great impetus to mechanical stapling devices was given by the Institute for experimental surgical apparatus and instruments in the mid-1950s.³ The early experience of Steichen and Ravitch⁴ with the original Soviet staplers convinced them of their potential uses in surgery, which provided the stimulus for American designers and manufacturers to create a family of staplers. Although many of the original staplers were developed from the basic principles utilized in the Soviet instruments, the skin stapler was a totally new kind of instrument in conception. This stapler, manufactured in the United States utilized a disposable, preloaded, presterilized magazine that contained 25 staples. A small sterile disposable cylinder containing carbon dioxide provided the driving force for the formation of rectangular skin staples. Steichen and Ravitch⁴ reported that this instrument saved considerable time during the operative procedure.

The first major change in the design of this skin stapler was to replace the carbon dioxide cartridge with a mechanical power source, a movable handle. By compressing the movable handle against a fixed handle, the surgeon generated sufficient force to form the rectangular staple.⁵ This metal stapler, which had to be cleaned and autoclaved before each surgical procedure, employed a sterile, disposable cartridge containing 25 to

35 staples that were easily positioned in the delivery end of the stapler. The time required to clean and autoclave these staplers was circumvented by then developing sterile disposable skin staplers.⁶ Several studies have been conducted to compare the use of staples and nylon sutures on the trunk, head, and neck; these revealed comparable cosmetic results. Advantages of staples include a decreased risk of tissue strangulation and infection, improved wound eversion, and minimal tissue reactivity. Disadvantages include the need for a second operator to evert and re-approximate skin edges during staple placement, greater risk of crosshatch marking, and less precise wound approximation. The cost is usually more than that of suture material. It is one of the purposes of this report to describe the scientific basis for the selection of skin stapling techniques. By understanding the influence of these staple closure devices on the biology of wound repair and infection, the surgeon can accomplish staple closure with the most aesthetically pleasing scar and with the lowest incidence of infection.

A study conducted by Kanegaye et al—1997, USA⁷ states staples cost 39% less than per wound closure & the complications reported were none. Stapling was fast than suturing per wound. Another study conducted by Ritchie AJ & Roke LG-1989, Northern Ireland⁸ states that the average speed of repair for staplers is 49 seconds and for skin sutures is 6 min & 20 sec. wound repair by staples is less painful than with skin sutures. There were no significant difference in cost & complications. Similarly study by Brickman KR & Lambert R Win 1989-USA⁹ stated that the average time taken for staplers is 30sec. one scalp wound & one leg wound dehiscd. Staplers were cost effective than sutures & compliance of was good. Study by MacGregor FB et al. in 1989, Scotland¹⁰ say that the meantime for stapler repair is 18.6 sec & for suture is 124 sec and the cost of repair and the complication rate were almost same. Patient compliance with stapler is good than sutures & no local anesthesia applied for stapling. Orlinsky Metal in 1995, USA¹¹ studies states that the average speed of stapling is 8.3 seconds per cm wound for staplers & 63.2 seconds per cm wound for sutures. The cost of wound repair per wound was significantly higher in skin sutures than staplers.

So from our study we found that the average time taken for skin closure by staplers is 1.84 min per 10 cm of wound & for skin sutures, it is 6.61 min per 10 cm of wound and complication rate for suturing is 30% & for staplers it is about 12%.

CONCLUSION

From the P value it is concluded that staplers are effective in terms of lower incidence of complication rate at the probability of 0.005. Staplers consume less time when compared to skin sutures particularly in major cases and in emergency which can reduce the duration of anesthesia. Since staplers reduce the complication rate it

is cost effective. Compliance for surgeon and patient is also good for staplers.

Apart from items that are used in wound closure there are other significant factors that contribute to overall complication rates that is 21% in this study (that is 6% for skin staplers and 15% for skin sutures). Outcome of staplers is cosmetically superior to skin sutures.

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Ethical approval: The study was approved by the institutional ethics committee

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