A Comparison of Three Methods Of Skin Closure By Using Subcuticular Vicryl Suture, Metallic Skin Stapler And A Steri-Strip Adhesive Tapes

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Abstract:

Background: Several new methods of skin closure had been used in surgical practice, and they are acceptable alternative to conventional trans cutaneous suture method, these are;
buried subcuticular vicryl suture, skin clips or stapler, and steri-strip adhesive tape. Thus the objective of this trial was to assess the impact of these closure methods on closure time, postoperative incision pain, potential wound complications, cosmetic outcome, and patient satisfaction.

Methods: 75 patients undergoing different elective and emergency operations were enrolled in this prospective randomized trial. They were divided into 3 groups, in each group(n=25), the incision closed by one of 3 methods: subcuticular vicryl suture, skin clips(stapler) or steri- strip adhesive tape. Closure time was assessed in theatre; postoperative incision pain was assessed at day 1 and day 5 postoperative. wound complications, and procedure patient satisfaction were assessed in the first 10 postoperative days. Assessment of cosmetic scar appearance was evaluated at 4 weeks follow up after operation.

Results: There was significant demographic difference among the three groups (p<0.05). There were no significant differences reported in postoperative incision pain (by visual analogue scale), wound complications (seroma, infection, dehiscence, and granuloma), patient procedure satisfaction, and cosmetic scar appearance(p>0.05). The skin stapler method was faster than other 2 methods (p<0.05).

Conclusion:
The three methods of skin closure (subcuticular buried vicryl, skin clips or stapler and steri- strip) are not routinely plasticizing methods of skin closure in our surgical practice, but they are acceptable new methods and had equal chance of surgeon preference, except in regard to the speed of closure, the skin stapler method is superior to other 2 methods.

Introduction:
In recent times, with advent of elective surgery, more energy has been directed at achieving an efficient and uncomplicated healing of the deliberately inflected wound. (Never judge the surgeon until you have seen him closing the wound) is saying attributed to lord Moynihan.(1)

The surgical scar remain the only visible evidence of the surgeon skills appearance.(1) The aim of closure of a surgical wound is to promote rapid healing by opposition of skin edges to leave a cosmetically acceptable scar. The technique should be watertight and tension free.

The best methods of wound closure would be one that provide adequate tensile strength to the incision until the wound is healed, approximate the tissue in a way that normal healing mechanisms can occur under optimal circumstances, remain secure even in the presence of local or systemic infection, the suture material is well tolerated on a short and long term basis, and finally, should be able to be done with expediency.(2)

The methods of skin closure generally used in surgery is with sutures which provide an extra source of contamination and are a potential source of foreign body reaction in the susceptible subcutaneous tissue(1).
This increases the complication rate besides being time consuming during application. To overcome these short comings, various methods of skin closure have been tried which include stapling and adhesive tapes. Proper closure technique is essential for obtaining good cosmetic results and avoiding infection, scarring and poor wound healing. Technique that must be mastered include good eversion of skin edges, avoiding suture marks, maintaining uniform tensile strength along skin edges and precise approximation of skin edges. (3)

The subcuticular buried suture: Buried sutures are important for obtaining wound eversion, providing prolonged wound tensile support and closing dead space (3). The most common suture materials in this technique are vicryl (polyglactic acid), PDS (polydioxanone) and maxon (polyglyconate). (3) Subcuticular buried sutures is very often used to close a surgical incision or a very clean wound. Absorbable material must be used, so the suture will not be removed at a later time. No suture is visible on the skin surface. (4)

Skin stapler: Skin stapler are sterile, disposable, cost effective, and useful for long linear laceration of the scalp, trunk, and extremities because they can be applied quickly with the same ultimate cosmetic results as suture. (4) It causing fewer infections than stitches. (5) Disadvantages of staples are permanent scar if used inappropriately and imperfect aligning of the wound edges, which can lead to improper healing. (5)

Skin closure tapes: The steri strip surgical skin closure is a non – invasive, adhesive-based wound closure device designed to treat low- tension lacerations and surgical incisions and painlessly and without the use of needles. (6)

The steri strip surgical skin closure is faster and easier to apply than suture, provide a time saving option for surgeon and other medical specialists. (6)

**Patients and methods:**

Prospective randomized clinical trials on 75 patients was done (male: 38, female: 37), their ages were between (10 – 65) years old, of different operations admitted to Al- Furat hospital and AL- Sader Hospital in Al-Najaf city from December 2006 to July 2007. The patients were divided randomly into 3 groups, each has 25 patients.

In the first group, the skin of incision was closed by buried subcuticular suture, in the second group, the skin was closed by metallic skin stapler, and in the third group, the skin was closed by steri-strip adhesive tape.

All patients underwent elective and emergency operations; infected operations were excluded. Each patients given per operative antibiotics prophylaxis when it s indicated, hair shaving, meticulous hemostasis and wound was irrigated by normal saline. Interrupted subcutaneous suture by using catgut 3/0 and then the skin was closed by one of the three methods. The choice of methods was random unless there is contraindications to clips or tapes, so we use subcuticular buried suture. We use disposable metallic skin stapler device containing 35 clips (proximate plus MD).

The skin tapes, we were used steri-strip (3M health care, 10 mm) and the subcuticular buried suture used by vicryl 4/0 (polyglactin 910- Sutupak).
Figure (1) show photograph of 3 patients of our study each one represent example of each method.

Patients with anemia, malnutrition, jaundice, and uremia were excluded (to avoid additional factor affecting wound healing). All patients were operated by same surgeon.
A- Right subcostal incision closed by buried subcuticular vicryl.

B- Midline incision closed by skin clips.

C- Collar incision closed by steri-strip
Figure (1): Methods of incision closure:(A,B, C)

Any wound complications like seroma, hematoma, wound infection and dehiscence were identified and reported and treated accordingly from fifth to 10th post operative day and was changed dressing, and removal of clips or steri-strip depend on site of incision.

We asked the patient to come back 4 weeks later for scar assessment. Scar assessment was done by one person (GP in dermatology) who had no idea about method of closure, who dose on of the five levels of scar appearance which were: (poor, fair, good, very good, excellent) and depend on alignment of scar, stitches marks, width of scar, elevation of scar and it’s colour as compared to adjacent skin.

The patients were asked about their satisfaction about the procedure type at 10th day post operative, so their answer were either YES (satisfied) or NO (not satisfied).

Any patient didn’t come for scar assessment was excluded from study.

Anova test and Post Hoc test had been applied for differences between mean at level of significance in addition to Chi- square applied for categorical variable.

Results:

The methods of surgical incision closure were divided into 3 groups:

Group 1(n = 25), include closure with subcuticular vicryl suture.

Group 2 (n= 25), include closure with skin clips.

Group 3 (n= 25), include closure with steri-strip adhesive tape.

Age and sex: The mean age of patients with groups 1, 2 and 3 was 28.56, 36.96 and 25.44 years old respectively as shown in table (1). P value < 0.05 which is significant.

Table (1): show mean age of the patients in the three groups.

<table>
<thead>
<tr>
<th>Age distribution</th>
<th>Number</th>
<th>Mean</th>
<th>SD</th>
<th>SE</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-subc. Vicryl (group 1)</td>
<td>25</td>
<td>28.56</td>
<td>11.43</td>
<td>2.28</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>2- skin stapler (group 2)</td>
<td>25</td>
<td>36.96</td>
<td>14.16</td>
<td>2.83</td>
<td>significant</td>
</tr>
<tr>
<td>3- steri strip (group 3)</td>
<td>25</td>
<td>25.45</td>
<td>10.46</td>
<td>2.13</td>
<td></td>
</tr>
</tbody>
</table>

SD: standard deviation
SE: standard error

Regarding the sex, females were more common in group 1 (68%), while males are more common in group 2 (64%) patients as shown in table (2).

Table (2) show gender distribution of patients in the group 1, 2

<table>
<thead>
<tr>
<th>Methods of closure</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Subcuticular vicryl (group 1)</td>
<td>8 (32%)</td>
<td>17 (68%)</td>
<td>25 (100%)</td>
</tr>
<tr>
<td>2-Skin stapler (group 2)</td>
<td>16 (64%)</td>
<td>9 (36%)</td>
<td>25 (100%)</td>
</tr>
<tr>
<td>3-Steri strip (group 3)</td>
<td>14 (56%)</td>
<td>11 (44%)</td>
<td>25 (100%)</td>
</tr>
</tbody>
</table>
Incision length and closure time: Regarding incision length and closure time, Table (3) show difference in Mean, Standard deviation, and Standard error between the three groups.

Table (3) show incision length and closure time in the three groups.

<table>
<thead>
<tr>
<th></th>
<th>Mean incision length \ cm</th>
<th>SD</th>
<th>SE</th>
<th>P value</th>
<th>Mean closure time \ minute</th>
<th>SD</th>
<th>SE</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- subc. Vicryl (group 1)</td>
<td>6.72</td>
<td>2.55</td>
<td>5.11</td>
<td>&lt; 0.05 significant</td>
<td>4.03</td>
<td>1.22</td>
<td>0.22</td>
<td>&lt; 0.05 significant</td>
</tr>
<tr>
<td>2- skin stapler (group 2)</td>
<td>9.24</td>
<td>4.97</td>
<td>0.99</td>
<td></td>
<td>1.09</td>
<td>0.82</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>3- steri strip (group 3)</td>
<td>4.75</td>
<td>2.48</td>
<td>0.50</td>
<td></td>
<td>2.32</td>
<td>1.20</td>
<td>0.24</td>
<td></td>
</tr>
</tbody>
</table>

SD: standard deviation
SE: standard error

Pain assessment:
Regarding pain assessment of incision of the patients in the three groups, Table (4) show difference in Mean, Standard deviation, Standard error between the three groups regarding pain at day 1 and at day 5 post operative.

Table (4): visual analogue scale in day 1 and day 5 post operative.

<table>
<thead>
<tr>
<th></th>
<th>Mean vas at day 1 (cm)</th>
<th>SD</th>
<th>SE</th>
<th>P value</th>
<th>Mean vas at day 5 (cm)</th>
<th>SD</th>
<th>SE</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- subc. Vicryl - group 1</td>
<td>3.68</td>
<td>1.72</td>
<td>0.34</td>
<td>NOT &gt;0.05</td>
<td>1.04</td>
<td>1.01</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>2- skin stapler - group 2</td>
<td>3.65</td>
<td>1.82</td>
<td>0.36</td>
<td>SIGNIF</td>
<td>1.44</td>
<td>1.20</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>3- steri strip - Group 3</td>
<td>2.32</td>
<td>1.20</td>
<td>0.24</td>
<td></td>
<td>1.20</td>
<td>0.81</td>
<td>0.16</td>
<td></td>
</tr>
</tbody>
</table>

SD: standard deviation
SE: standard error
VAS: visual analogue scale

Wound complications: Wound complications in the three methods were, seroma reported in group 1 and 2, (4%) for each. Hematoma was reported in group 1 (4%), superficial wound dehiscence and granuloma were reported in group 3, (4%) for each. Wound infection was reported in group 1 (8%) and in group 2 (4%) as shown in table(5).
Table (5): show wound complications related to the three groups.

<table>
<thead>
<tr>
<th>Methods of closure</th>
<th>Seroma (4%)</th>
<th>Hematoma (4%)</th>
<th>Superficial wound dehiscence</th>
<th>Granuloma (4%)</th>
<th>Infection (8%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Subcuticular vicryl (group 1)</td>
<td>1 (4%)</td>
<td>1 (4%)</td>
<td>-</td>
<td>-</td>
<td>2 (8%)</td>
</tr>
<tr>
<td>2- Skin stapler (group 2)</td>
<td>1 (4%)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>3- Steri- strip (group 3)</td>
<td>-</td>
<td>-</td>
<td>1 (4%)</td>
<td>1 (4%)</td>
<td>-</td>
</tr>
</tbody>
</table>

**P VALUE > 0.05**

Scar assessment: Regarding the scar assessment in the three groups, the best scar appearance reported in group 1 and 3, as a maximum of scar appearance was good, very good and excellent as shown in table (6) and figure (2).

Table (6): show scar assessment for group 1, 2 and 3 of closure

<table>
<thead>
<tr>
<th>Methods of closure</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very good</th>
<th>Excellent</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcuticular vicryl (group 1) n= 25</td>
<td>-</td>
<td>6 (24%)</td>
<td>8 (32%)</td>
<td>8 (32%)</td>
<td>3 (12%)</td>
<td>25</td>
</tr>
<tr>
<td>Skin stapler (group 2) n= 25</td>
<td>2 (8%)</td>
<td>7 (28%)</td>
<td>12 (48%)</td>
<td>4 (16%)</td>
<td>-</td>
<td>25</td>
</tr>
<tr>
<td>Steri- strip (group 3) n= 25</td>
<td>-</td>
<td>5 (20%)</td>
<td>13 (52%)</td>
<td>5 (20%)</td>
<td>2 (8%)</td>
<td>25</td>
</tr>
</tbody>
</table>

**P VALUE > 0.05**
Discussion:

Our clinical trial was studied three of not commonly used methods of skin closure of different surgical incisions.

We were compare 3 methods (buried subcuticular vicryl, skin clips & steri-strip)without control group depending on specific statistical tests (Post hoc and Annova) which are used for different variables.

The age and sex differences were significant (P<0.05). Youngest age group was in steri-strip group, but that did not affect the results of other variables, specially wound complications and cosmetic scar appearance.

The mean closure time was the shortest in skin clips group (P<0.05), although the same group had the maximum mean of incision length. That mean, the skin clips is the most rapid method, followed by steri-strip group (P<0.05). So the surgeons can close long incisions in a short time and less effort. (7)

If we compare with other studies, Khan, Abu N.G.A., et al, shown in their study that skin clips skin closure were more rapid than subcuticular suture in closure of scalp wounds.(8)

Shetty (2004), et al, also shown that skin clips method was faster than subcuticular suture in hip wounds closure. (9)

Other literatures shown that steri-strip method was faster than subcuticular vicryl in closure of face, head and hand wounds. (5,6)

The postoperative pain assessment was not statistically significant among the 3 groups (P>0.05), both in day 1 and day 5 postoperatively, although the steri-strip group had relatively the minimum mean of VAS score (2.32) in day 1 postoperatively.

Cara (2006), shown in her study that subcuticular vicryl suture had less pain than skin clips in closure of pfannestiel skin incisions. (10)

Obermair (2007), et al, shown that skin stapler or clips and subcuticlar buried suture had the same results of post operative pain in closure of laprotomy incisions for gynecological surgery. (11)

Other literatures shown that steri-strip skin closure had less pain than subcuticular suture. (5,6)
We reported in our study different wounds complications, but there was no significant difference among the three groups (P>0.05). Relatively, the subcuticular group had the highest complication rate (16%).

Shetty, (2004), et al, shown that skin staplers group had more complications than subcuticular group. (9)

Obermair (2007), et al, shown the same complication rate between skin clips and subcuticular suture groups. (11)

Robert G (1997), et al, shown that subcuticular buried sutures had less infection rate than skin stapler in cutaneous closure after cardiac operations. (12)

The steri-strip skin closure method had less infection rate than subcuticular suture method, as steri-strip had no foreign body in the wound. (5,6,7) The superficial wound dehiscence was due to premature detachment of steri-strip tape because either excessive sweating, movement of patient or non perfect application of skin tape.

So the steri-strip skin closure method is non invasive, less pain and less infection.

The cosmetic scar appearance was statistically the same in the 3 groups of our study, the p value was not significant (P>0.05).

Shetty, (2004), et al, shown that subcuticular suture had better cosmetic scar appearance than skin clips. (9) Khan, Abu N.G.A., et al, shown that the skin staplers had better cosmetic scar appearance than subcuticular suture. (8)

Obermair (2007), et al, study revealed the same cosmetic results between skin clips skin closure and subcuticular suture.

The steri-strip skin closure had better cosmetic scar appearance than subcuticular buried suture. (5,6,7)

The scar appearance of any wound affected by many factors, including age and sex of the patient, type of skin closure, site of incision and its relation to skin tension lines, and postoperative wound complications. (13)

As shown in our study, there was no effect of age and sex of the patients on the scar appearance among the three groups in spite of significant difference in age and sex and this could be due to small numbers of patients in our trials.

The type of skin closure (as shown) did not affect the scar appearance, although the skin stapler group had relatively highest number of (poor) and (fair) results of scar assessment and relatively higher complication rate in subcuticular group (16%).

The patients procedure satisfaction was not statistically different among the three groups of our study (P>0.05). The skin clips had painful feature during its removal, so it can affect adversely patient satisfaction, as well as wound complications when it occurred it can affect adversely patient satisfaction, but that was statistically un supported.

So, the three methods of skin closure (subcuticular buried vicryl, skin clips or stapler and steri-strip) are not routinely plasticizing methods of skin closure in our surgical practice, but they are acceptable methods and had equal chance of surgeon preference, except in regard to the speed of closure; the skin stapler method is superior to other two methods.

Conclusion:
In the practical point of view, the three methods of skin closure (subcuticular vicryl, skin stapler, and steri-strip) are ready to gain popularity in surgical practice. That three methods, in this trial, were equivalent in terms of postoperative pain, wound complications, cosmetic scar appearance, and patient satisfaction. There was statistical evidence support the skin stapler method to be faster than other two methods.

References:
8. Khan, abu N. G.A. M.D., MS; Dayan, Peter S. M.D; Miller Steven M.D; Rosen, Michael M.D; Rubin, David H. M.D., cosmetic outcome of scalp wound closure with staples in the pediatric emergency department: a prospective, randomized trial. 2002; 18 (3): 171-173.