ABSTRACT
In modern times with the advent of elective surgery, more energy has been directed at achieving an efficient and uncomplicated healing of deliberately inflicted wound. The surgical scar remains the only visible evidence of surgeon’s skills and not infrequently all of his efforts are judged on its final appearance. The ideal surgical wound is one which would be as strong as normal tissue the moment it is closed. The purpose of skin closure technique is to hold skin edges together for a sufficient length of time to allow proper healing to occur. In an endeavour to give cosmically good looking scar to the patient after surgery, numerous techniques have been devised for skin closure by the surgeons all over the world. In this study we compare sutureless techniques of skin closure (staplers) with tissue adhesive glues in terms of time consumed in surgical skin incision closure, post op pain perception, rate of wound complication and cosmetic appearance of scar.

Keywords: Staplers, Skin Closure, Tissue Adhesive Glue, 2-octyl Cyanoacrylate

INTRODUCTION
In modern times with the advent of elective surgery, more energy has been directed at achieving an efficient and uncomplicated healing of deliberately inflicted wound. The surgical scar remains the only visible evidence of surgeon’s skills and not infrequently all of his efforts are judged on its final appearance. In order to minimize surface scar when the wound is deeper and extensive, each of the divided structures must be closed in tiers “like tissues to like tissues” beginning in depth of wound and continuing upwards.

The ideal surgical wound is one which would be as strong as normal tissue the moment it is closed. This of course, is not obtainable. Douglas found that 80% of normal strength in fascia was the highest that could be demonstrated even in the wounds which had been followed as long as one year (Douglas and Forester, 1969). The purpose of skin closure technique is to hold skin edges together for a sufficient length of time to allow proper healing to occur. The edges should be brought together without vertical or horizontal deviation and without inversion.

In an endeavour to give cosmically good looking scar to the patient after surgery, numerous techniques have been devised for skin closure by the surgeons all over the world.

Various available techniques for wound closure are:-
1. Conventional percutaneous sutures which may be interrupted or continuous sutures using usually non-absorbable material like cotton, silk or nylon.
2. Subcuticular sutures using either absorbable suture material like catgut or polyglycolic acid or non-absorbable suture material such as polypropylene or nylon.
3. Metal clips of various types.
4. Sutureless wound closure using either steristrips or sterile adhesive tapes.
5. Recently various adhesive materials have come into vogue for the purpose of skin approximation like N-Butyl-2-cyanoacrylates and Isoamyl-2-cynoacrylate

Aim of the study was to compare sutureless techniques of skin closure i.e staplers with tissue adhesive glues in terms of:
1. Time consumed in surgical skin incision closure.
2. Post op pain perception
3. Rate of wound complication

Cyanoacrylates are glue type materials which are present in market for about more than 30 years. Particularly cyanoacrylates (butylcyanoacrylates and Isoamyl-2-cyanoacylate) are in use for various purposes for quite a considerable time. Binnie and Forrest (1947) histologically compared cyanoacrylates and silk sutures which were used in the immobilization of periodontal flaps. The results indicated minimal edema and swelling and better gingival contour by using cyanoacrylates (Binnie and Forrest, 1947).

The scars resulting from application of acrylates were compared with the scars resulting from subcuticular skin closure and it was noted that post-operative pain, discomfort and erythema of the wound margins was significantly less when the tissue adhesive was used. Adoni and Anteby (1991) used cyanoacrylates in the repair of various episiotomy wounds and found markedly decreased post operative pain as compared to the suture group. The need for the removal of stitches after healing was also obviated (Adoni and Anteby, 1991).

Zaki et al., (1994) evaluated the effectiveness of butyl 2-cyanoacrylate tissue adhesive in split-thickness skin grafts in 19 patients with severely damaged skin. They found that split skin grafts were healed successfully in all patients with complete absorption within 6 months without foreign body reaction (Zaki et al., 1994). Further research revealed that by changing the alkyl chain in the compound to one with a longer molecular chain, the tissue toxicity can be considerably reduced or virtually eliminated.

Today medical grade products using butyl, isobutyl, octyl esters and Isoamyl-2-cyanoacrylate are available across the world.

In this study, we will employ 2-octyl cyanoacrylate which is one of the series of homologues called alkyl cyanoacrylate.

The adhesive property of 2-Octyl--cyanoacrylate is because of the fact that in monomer form the cyanoacrylate is a liquid and upon contact with weak bases such as water it quickly forms strong polymer bonds and solidifies, when solidifying it changes from monomeric to polymeric forms but remains same chemically.

**Salient Features:**

1. Biocompatibility: 
2. Quick adhesion: 
3. Haemostatic effect: 
4. Bacteriostatic: 
5. Enhanced cosmetic appeal:

**Composition:** Each sterile ampoule of Dermabond is available in ampoules of 0.36 ml and 0.5 ml.

Surgical staples are specialized staples used in surgery in place of sutures to close skin wounds, connect or remove parts of the bowels or lungs. Stapling is much faster than suturing by hand, and also more accurate and consistent. Surgical stapling was developed in 1908 by HultiHumer in Australia. Original instrument was massive by today’s standards weighing 7.5 pounds.

Modifications provided by Von Petz provided a lighter and simpler device and in 1934 Fredrick of Ulm designed an instrument that resembled today’s linear stapler. The next major advances came from Russia after World War 2. Ravich (1958) who through research and development refined the instruments to their current state today. The first commercial staplers were made of stainless steel with titanium staples loaded into reloadable staple cartridges. Modern surgical staplers are either disposable and made of plastic, or reusable and made of stainless steel. Both types are generally loaded using disposable cartridges.

Although most surgical staples are made of titanium, stainless steel is more often used in some skin staples and clips. Titanium produces less reaction with the immune system and, being non-ferrous, does not interfere significantly with MRI scanners, although some imaging artifacts may result. Synthetic absorbable (bioabsorbable) staples are also now becoming available, based on polyglycolic acid, as with many synthetic absorbable sutures. Titanium staples are never solely titanium; they all have some amount of nickel content.
Advantages of stapling include:
1. Ease of use
2. Rapidity
3. Cost effectiveness
4. Minimal damage to host defenses

MATERIALS AND METHODS
Sample size of 100 cases including both pediatric and adult patients undergoing elective surgery in General Surgery department of SGRDIMSR With wound length of less than 10 cm was taken. Follow up period of 3 months post operatively was considered.

Patients were divided into two groups:
Group A - 50 patients undergoing closure of skin incisions by TISSUE ADHESIVE GLUE.
Group B - 50 patients undergoing closure of skin incisions by SURGICAL STAPLES

Exclusion Criteria were:
1. Wound length >10 cm
2. No informed and written consent.
3. Comorbid conditions like malnourishment and renal failure.
4. Metabolic disorders like diabetes, coagulation disorders, immunocompromised etc.
5. Local causes like burns, keloids etc.

Assessment
Time taken for closure of skin incisions was measured in both groups intraoperatively.
Post operative pain perception on 1st two post operative days by following methods:
A. FLACC Score for the children below 7 years of age.
B. Visual analogue scale for adults and children above 7 years of age.
Pain is graded as follows in both groups:
1–3: Mild discomfort
4–6: Moderate pain
7–10: Severe discomfort or pain or both

Wound in both groups were assessed on 2nd and 5th post operative day for:
1. Surrounding erythema,
2. Tenderness
3. Discharge from wound site.

Wound in both groups were again reassessed at time of removal of skin staples (which is between 8 and 14 days) for following:
1. Any gaping of wound
2. Discharge from wound site.
3. Cosmetic appearance.

At 1 month patient were assessed for:
1. Scar hypertrophy of wound.
2. Cosmetic appearance of wound site.

At end of 3 months patients were assessed for Scar Hypertrophy which was categorized as follows:
- Excellent: linear flat scar of width less than 2 mm.
- Good: flat, linear scar of width less than 3 mm.
- Fair: minimally raised scar of width less than 5 mm.
- Poor: more than 5mm width and hypertrophied scar.

Observations
As shown in Table-1, 40% of the operations in both the groups were hernioplasty/herniotomy, 20% of the operations were orchidopexy, another 20% were open cholecystectomies, 10% were open appendicectomies, 6% were renal surgeries either pyeloplasty or nephrectomies, 4% were fibroadenoma excisions.
For better comparison the number of patients of a particular operation was kept same in both the groups.

**Table I: Various Operative Procedures In Group A And Group B**

<table>
<thead>
<tr>
<th>Operation Performed</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hernioplasty or herniotomy</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Orchidopexy</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Open cholecystectomy</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Open appendicectomy</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Pyeloplasty/ nephrectomy</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Fibroadenoma</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

Since the number of patients of a particular operation were same in the two groups, so the percentage of types of incisions were exactly the same in both the groups because same type of incision was given for a particular operation in either group. Hence 60% of incisions in both the groups were inguinal. This type of incision was used for hernioplasty/herniotomies/ orchidopexy. 20% of the incisions in both the groups were right subcostal which were used for open cholecystectomies. 10% of the incisions in each group were grid iron incisions which were used for appendicectomies. 6% of the incisions in each group were lumbar used for renal surgeries either pyeloplasties or nephrectomies. 4% of the incisions in group were circumareolar incision which was used for fibroadenoma excision. The minimum length of incision was 2.5 cm in group A and 2 cm in group B. The maximum length of incision in group A was 8.5 cm whereas it was 6 cm in group B. Mean length in group A was $3.97 \pm 1.25$ and in group B was $3.94 \pm 1.12$ and $p = 0.900$ and show no significant difference between group A and B with respect to length of the incision.

The age difference was also not significant in the 2 groups .In group A, the age range varied from a minimum of 6 months to a maximum of 79 years and in group B from a minimum of 4 months to a maximum of 57 years. The mean age in group A was $19.41 \pm 19.89$ years and Group B was $19.43 \pm 17.10$ years and $p = 0.996$.

**Table 2: Showing Time For Application**

<table>
<thead>
<tr>
<th>Duration</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>90 – 160</td>
<td>20 – 125</td>
</tr>
<tr>
<td>Mean</td>
<td>$125.80 \pm 11.75$</td>
<td>$48.60 \pm 23.73$</td>
</tr>
</tbody>
</table>

Group A v/s Group B $t = 20.612; p < 0.001; \text{Highly Significant}$

As shown in table 2 the time of application was significantly more in cases of cyanoacrylates.

In patients below 7 yrs of age pain perception was measured according to FLACC score. 16 patients in Group A experienced mild pain on 1st post operative day as opposed to 10 patients in Group B. While just 7 patients experienced moderate pain in Group A as opposed to 14 patients in Group B. Similarly on 2nd post operative day 15 patients in Group A experienced no pain as opposed to 10 in Group B while just 10 patients in Group A experienced mild pain as opposed to 16 in Group B. Therefore as seen in above tables pain experienced in Group B patients below 7 years of age was significantly more as opposed to Group A patients below 7 years of age.

In adults and children above 7 years of age 14 patients experienced mild pain in Group A as measured according to Visual Analogue Scale on 1st post operative day as opposed to 9 patients in Group B while just 4 patients in Group A experienced moderate pain as opposed to 10 in Group B. Similarly on 2nd post operative day 13 patients IN Group A experienced no pain as opposed to 10 in Group B while 8 patients in Group A still experienced mild pain as opposed to 10 in Group B.
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The condition of the wound was measured on day 2 in terms of erythema, induration, tenderness and presence of any serous collection/discharge. It was observed that 8 (16%) patients in group A had erythema around the wound site and 15 (30%) had erythema in group B. Erythema is expected in the initial days after injury produced by incision and tissue manipulation during surgery, but it was significantly less in group A as compared to group B as more trauma was caused while applying skin staplers.

24 (48%) cases in group A had induration as compared to 34 (68%) in group B. This denotes that skin stapling resulted in more induration as compared to 2-octyl cyanoacrylate.

Tenderness which was assessed by gentle palpation along the entire length of the wound was positive in 15 (30%) cases in group A and 30 (60%) cases in group B. This clearly shows that 2-octyl cyanoacrylate is associated with much less tenderness than skin staplers.

1 (2%) case in group A showed serous collection/discharge. It was in one case of appendicectomy that there was evidence of serous discharge on 2nd post-operative day from one end of the Wound and consequently there was gaping of the whole wound on the 4th day along with mild infection. As much as possible the serous discharge was expressed from the wound and the wound was cleaned and redressed. Subsequently we had to do resuturing in this case with percutaneous sutures, but the final cosmetic outcome of the scar was poor.

There was serous collection in 4 (8%) cases in group B. 2 cases of cholecystectomy, 1 case of hernia repair, and one case of appendicectomy had this wound complication. They were all managed in the same way as the wounds managed above. The final cosmetic outcome of the scar was fair in 3 cases and poor in 1 case.

Wound complications were inspected on day 5 in terms of erythema and presence of any serous collection/discharge. 2 (4%) patients in group A had erythema around the wound site and 6 (12%) had erythema in group B at 5th post-operative day.

In both the groups incidence of erythema was reduced at 5th postoperative day as expected as the patients were given anti-inflammatory medications although incidence of erythema among Group B patients 6 (12%) was still significantly higher than Group A patients 2 (4%).

We observed that none of the cases in group A showed serous collection/discharge at 5th post-operative day. The single case of appendicectomy that showed serous discharge/ collection at 2nd post-operative day was managed conservatively with regular dressings and expressing out as much discharge from wound as possible although final cosmetic outcome was poor.

There was serous collection in 3 (6%) cases in group B. all the cases of Group B which showed serous discharge on 2nd post-operative day were managed with removal of staples from appropriate site , expressing out as much discharge as possible and daily dressings. With this conservative management discharge disappeared completely in 1 case of herniotomy and rest of the cases still showed some evidence of discharge though it was significantly reduced. The final cosmetic outcome of the scar was fair in 3 cases and poor in 1 case.

Staples were removed after 7-10 days of surgery and the Wound was inspected for serous collection/discharge, skin gaping and cosmetic appearance.

10 (20%) case in group A developed skin gaping. Out of these 5 was cholecystectomy, 4(8%) were hernia repairs, 1 was appendicectomy. Most of these were adult patients with wound length greater than 4 cm and only 1 was paediatric pt. who underwent herniotomy and had wound length less than 4cm. so it was generally observed that incidence of wound gaping is higher in skin closure done with 2-octyl cyanoacrylate in adult patients with longer incision generally greater than 4cm. most of these patients were managed conservatively and 2 had good outcome ultimately, 6 had fair and 2 had poor.

In group B 6 (12%) cases developed wound gaping which can be attributed to the serous collection/discharge in these cases. These patients were also managed conservatively with daily dressings of which 1 had good outcome, 4 had fair and 1 had poor. Hence, in our study, the incidence of gaping was more in case of dermabond skin closure as compared to staples especially in adult patients.
Table 3: Showing Cosmetic Results At Time Of Discharge

<table>
<thead>
<tr>
<th>Cosmetic results</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent (width &lt;2 mm)</td>
<td>22 (44%)</td>
<td>10 (20%)</td>
</tr>
<tr>
<td>Good (width &lt;3 mm)</td>
<td>21 (42%)</td>
<td>25 (50%)</td>
</tr>
<tr>
<td>Fair (width &lt;5 mm)</td>
<td>7 (14%)</td>
<td>13 (26%)</td>
</tr>
<tr>
<td>Poor (width &gt;5 mm)</td>
<td>3 (6%)</td>
<td>2 (4%)</td>
</tr>
</tbody>
</table>

\( \chi^2 = 8.403; \text{ df}=3; p = 0.038; \text{ Significant} \)

P value was 0.038. So overall cosmetic outcome was significantly better in Group A patients as compared to group B.

Scar hypertrophy was noted in 2 (4%) cases in group A and 4 (8%), rare in group B. The cosmetic outcome of the wounds was assessed at 4 weeks. Thus 30 (60%) of patients in group A and 16 (32%) patients in group B had excellent scars. 10 (20%) in group A and 22 (44%) in group B had good cosmetic outcome. 7 (14%) in group B had a fair cosmetic outcomes. 3 (6%) in group A and 5 (10%) in group B had a poor cosmetic outcome. P value was 0.026. Therefore overall cosmetic outcome was significantly better in Group A as compared to Group B patients.

Incidence of scar hypertrophy in both groups was same as noted at 1 month post operatively. Cosmetic outcome of wounds was assessed. The results were almost similar to that noted at 1 month post operatively. As noted in above table results of cosmetic appearance were almost similar to that observed at 1 month interval except for few variations in Group b patients as 15 (30%) patients had excellent scar, 9(18%) patients had fair outcome and 4 (8%) patients had poor outcome. P value was 0.019. So overall cosmetic appearance in Group A was significantly better as compared to Group B.

RESULTS AND DISCUSSION

Results and Conclusion

Tissue adhesive glue (2-octyl cyanoacrylate) scores over skin staplers in terms of closure of smaller sized wounds upto 4 cm which are especially found in paediatric age group because of the following:

1. There is no need to remove the staples, so the patient is saved of extra burden of coming again for staple removal and is also saved of pain associated with staple removal.
2. Post-operative pain experienced by the patient is lesser as compared to staples.
3. Post-operative complications like erythema, induration, tenderness, stitch sinus, scar hypertrophy are significantly less as compared to staples.
4. There is no need of daily dressing and extra cost of daily dressing saved with escape from daily pain during dressing.
5. Patient can take bath after 48 hours as DERMABOND is not water soluble.

But there were several areas where staplers scored over tissue adhesive glues which are as follows:

1. Easier to apply over larger wounds as no perfect hemostasis is required.
2. In case of any collection a staple or 2 can be opened from part of wound to allow collection to drain.
3. Staplers are cheaper than glue.
4. Time of application is markedly lesser.

Discussion

The basic requirement of any skin closure is that it should hold the skin edges in apposition for a sufficient length of time to allow proper healing to occur. There must be no movement between skin edges whilst the healing proceeds, but excessive tension on wound edges must be avoided if a sound repair is to be effected. In healing by primary intention the purpose of skin closure is to oppose skin edges and to exclude infection from the deeper layers. The incisions, following tension lines or natural skin folds and ensuring proper skin relaxation have been prevalent since time immemorial.

There are a number of well proven techniques of skin closure employing a variety of materials, for example suturing materials, tapes, clips and adhesives.
Research Article

In the present study two sutureless techniques of skin closure i.e. tissue adhesive glue (2 octylcyanoacrylate) and skin staplers were compared. The aim was to compare these 2 techniques in terms of time taken for skin closure, post operative pain perception, various post operative complications as erythema, collection/discharge, and wound gaping and finally cosmetic appearance of wound.

Patients belonging to all age groups of both the sexes were included in the study. The age ranged from 6 months -79 years in group A and 4 months - 57 years in group B.

As evident from table I, operations were eitherherniotomies/hernioplasties, orchidopexy, cholecystectomies, open appendicectomies, pyeloplasty/ nephrectomy and fibroadenoma. So majority of incisions were oblique inguinal, right subcostal transverse, or grid iron. The major surgical procedures resulted in comparatively larger wounds were not included in the study because adhesive materials cannot hold such a long length of skin edges together and had to be supplemented with skin stitches in order to keep the skin edges opposed to each other. Secondly, the material required to close a long incision was more and since the material is expensive it was not feasible in all cases. Thirdly, it was very difficult to keep the edges opposed to each other in long wounds in a uniform manner for 30 seconds to 2 minutes, the time required for it to become opaque signifying polymerization.

Many workers evaluated this material only in a particular type of wound, like Adoni and Anteby (1991) used tissue adhesive for the closure of episiotomy wounds (Adoni and Anteby, 1991). Samuel et al., (1997) and Maw et al., (1997) evaluated this material in skin wounds resulting from head and neck surgery. In another study conducted by Simon et al., (1998) cyanoacrylate was shown to be a preferred method of cutaneous closure of lacerations oriented against the langer's lines.

So, in none of the studies, adhesive material was tried for the closure of long skin wounds. The wounds most commonly closed were either small to medium sized facial lacerations or oblique to transverse skin incision as in the present study.

As depicted in the study the minimum length of incision in Group A was 2.5 cm and maximum length of incision was 8.5 cm. Thus the adhesive was used to close only small or medium sized operative wounds. This again corresponds to the above said limitation of cyanoacyrlates (Dermabond), that they cannot be used in the closure of long skin wounds.

The age in Group A ranged from a minimum of 6 months - year to a maximum of 79 years and in Group B from a minimum of 4 months to a maximum of 57 years. Dermabond was however better suited for paediatric age group with wound length less than 4 cm as it was easier to apply on smaller length wounds.

In all cases 2-octyl cyanoacrylate took more time (range 90-160, mean 125.80± 11.75 sec) as compared to application of skin staplers (range, mean 48.60 ± 23.73).

In a study conducted by Ridgway et al., (2007) average time taken for closure of cervicotomy incision in neck surgeries with glue was much more than with skin staplers with a mean difference of 67 sec (Ridgway et al., 2007).

Khan et al., (2006) reported average time for skin closure in the adhesive group to be 100 sec and the average time for the placement of staples 30 sec in patients undergoing arthroplasty i.e TKR or THR (Khan et al., 2006). According to Chibbaro and Tacconi (2009), there was no significant difference between surgical adhesive glue and skin staples for closure of neurosurgical scalp incisions (Chibbaro and Tacconi, 2009).

It can be concluded that the pain felt by the patient during first 2 post-operative days was less in group A (cyanoacrylate) than in group B (skin staplers). 2 patients in each group experienced severe pain on 1st post operative day in children below 7 years of age. While 14 patients in Group B experienced moderate pain as compared to only 7 in Group A. on 2nd post operative day 15 patients in group A experienced no pain at all as compared to 10 in Group B.

In adults and children above 7 years of age pain was measured according to visual analogue scale. Patients in Group A suffered from moderate pain on 1st post operative day as compared to 10 patients in group B. similarly on 2nd post operative day 8 patients continued to suffer mild pain as compared to 10 in Group B.
Post-operative erythema was significantly less in cyanoacrylate group, 8 (16%) cases as compared to percutaneous suture group 15 (30%) cases. This shows that skin staplers cause more trauma to the operative site as compared to tissue adhesive. 24 (48%) cases in group A had in duration as compared to 34 (68%) in group B. This denotes that staples resulted in more in duration as compared to non-suture closure using cyanoacrylate.

Tenderness was assessed by gentle palpation along the entire length of the wound and was positive in 15 (30%) cases in cyanoacrylate group and 30 (60%) cases in staples group. This clearly shows that tissue adhesives are associated with much less tenderness as compared to staples.

1 (2%) patient in cyanoacrylate group showed serous collection/discharge as compared to 4 (8%) in staple group after 2 days of operation. While none of the patients showed discharge on 5th post operative day in cyanoacrylate group, 3 (6%) patients in staple group continued to have discharge on 5th post operative day and at time of removal os staples.

The serous collection was perhaps due to imperfect haemostasis at the time of closure of the wound. Tissue oedema and ischaemia of the wound edges encountered in stapling technique in interrupted suturing technique also leads to serous collection. Comparative incidence of serous collection in studies carried out by other workers is shown in Table 4.

Table 4: ?????

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of author and year</th>
<th>Total cases</th>
<th>Incidence of serous collection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Group A</td>
<td>Group A</td>
</tr>
<tr>
<td>1.</td>
<td>Khan et al., (2006)</td>
<td>63</td>
<td>60</td>
</tr>
<tr>
<td>2.</td>
<td>Chibbaro and Tacconi (2009)</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>3.</td>
<td>Present study</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

In the present study incidence of serous collection was less in group A. The reason may be that more meticulous haemostasis was tried in group A.
Khan et al., (2006) and Chibbaro and Tacconi (2009) had no significant difference as regards serous collection in their studies between both groups. 10 (20%) cases in group A developed gaping as compared to 5 (10%) in Group B. Upon detailed analysis of incidence of skin gaping in both groups it was observed that most (80%) of incidence of skin gaping in Group A occurred in incisions greater than 4 cm while there was no such observed difference among Group B patients.

As observed scar hypertrophy/cosmetic results were consistently better among Group A patients at time of discharge, 1 month and 3 months. While 22 (44%) showed excellent outcome in Group A patients at time of discharge only 10 patients in group B showed excellent outcome. Similar results were observed at 1 and 3 months.

It was observed that most patients in Group A who showed fair or poor outcome were the ones who had skin gaping post operatively while most patients who showed poor outcome in Group B either had serous collection or skin gaping post operatively. Therefore poor outcomes in either group can be attributed to skin gaping or serous collection.

In most of the other studies cosmetic outcome was measured according to 10 point scale and there was no significant observed difference between both groups in all studies mentioned previously.

REFERENCES