DISCUSSION

The present study titled “Mitomycin –C for the prevention of adhesion formation after Functional Endoscopic Sinus Surgery (FESS) in Chronic Rhinosinusitis (CRS) cases” was undertaken at KLES Dr. Prabhakar Kore Hospital and Medical Research Center (MRC), Belagavi from May 2011 to July 2014. A total of 150 patients of CRS were included- 75 patients in Group-A (MMC) and 75 in Group-B (Normal Saline). Further, there were 30 unilateral cases and 45 bilateral cases, thus totally making 120 operative sides in each group.

The basic demographic data like age, sex, symptoms, radiological (CT) scoring and endoscopic scoring were compared between the 2 groups to ensure fair distribution of patients. The patients were evaluated minimum 3 months post-operatively for rate and severity of adhesions as well as symptomatic outcome between 2 groups.

The discussion was done under the following headings

I. Comparison of demographic characteristics – According to the study design, the Group A and Group B patients were compared in the following independent variables- Age, Sex, Preoperative Symptoms, Preoperative CT Score, Preoperative endoscopic scoring.

II. Association of CRS and Nasal polyposis (NP).

III. Operative Procedures / Additional procedures done

IV. Objective evaluation: The various endoscopic findings used for objective evaluation were-Adhesions (rate of adhesions, grades of adhesions and difference in the rate of adhesions), Crusting, Polypoidal mucosa and Discharge.
V. **Subjective evaluation was done by using**

1) Severity of 4 symptoms-Facial pain/pressure, Nasal obstruction, Nasal discharge and Hyposmia.

2) SNOT-20 total score and four domains of SNOT namely- Rhinologic, Ear & facial domain, Sleep domain and Psychologic domain.

### 5.1 Comparison of demographic characteristics – Age, Sex, Preoperative Symptoms, Preoperative CT Score, Preoperative endoscopic scoring.

#### 5.1.1 Age distribution:

Patients between the age group of 17-66 years were included in the study. The selection of this age group was based on the knowledge that sinus pneumatization is known to occur throughout adolescence. In the present study, more number of patients (86 [57.33%]) were in the age group of 21-30 and 31-40 years. Out of 86 patients, 45 were in group A and 41 were in group B. The Chi square value was 1.8414, p=0.76488, it shows that there is no difference between groups in distribution of patients by age. The mean age was 34.49 ± 12.76 in group A and 36.65 ± 13.12 in group B.

In the study conducted by Gupta M et al (2006)\(^ {17}\) there were maximum number of patients i.e. 76.6% in 2\(^{nd}\) and 3\(^{rd}\) decade.

A study by Chopra H et al (2006)\(^ {114}\) the mean age of presentation was 35 years with the age range of 5-65 years.

In a study by Chung J H et al (2002)\(^ {19}\) the age range was 21-75 years with the mean age of 44.5 years.

A study by Kim ST et al (2006)\(^ {15}\) the average age of presentation was 31 years (range 16-65 years).
A study by Baradaranfar MH et al (2010) had mean age of 38 years with range 14-66 years with follow up period 3-5 months (mean 3.5 months).

A study by Netkovski J et al (2006) showed the mean age of 46.3 years the range being 18-61 years.

A study by Tilakraj Singh et al (2011) showed the average age of presentation of CRS was 33 years (Table: 32).

Hence the above studies showed CRS is being common in second and third decade and the mean age of presentation falls in the range of 35-45 years.

### Tables 32: Age wise distribution of cases in different studies

<table>
<thead>
<tr>
<th>Name of author</th>
<th>Year</th>
<th>Mean Age (in years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chung J H et al</td>
<td>2002</td>
<td>44.5</td>
</tr>
<tr>
<td>Chopra H et al</td>
<td>2006</td>
<td>35</td>
</tr>
<tr>
<td>Netkovski J et al</td>
<td>2006</td>
<td>46.3</td>
</tr>
<tr>
<td>Kim ST et al</td>
<td>2006</td>
<td>31</td>
</tr>
<tr>
<td>Baradaranfar MH et al</td>
<td>2010</td>
<td>38</td>
</tr>
<tr>
<td>Tilakraj Singh et al</td>
<td>2011</td>
<td>33</td>
</tr>
<tr>
<td>Present Study</td>
<td>2015</td>
<td>35.57</td>
</tr>
</tbody>
</table>

#### 5.1.2 Sex distribution:

In the present study, out of 150 patients, 98 (65.33%) were males and 52 (34.66%) were females. Further out of 98 males, 46 (61.33%) were in group A and 52 (69.33%) were in group B. The difference in distribution of male and female patients in two groups was not significant (Chi square value 1.0601, p = 0.3033).
In the study conducted by Gupta M et al (2006)\textsuperscript{17} male patients were 66.6% and 33.3% were females.

In a study by Chopra H et al (2006)\textsuperscript{114} there were 33 (66%) males and 17 (33%) female patients.

In a study by Kim ST et al(2006)\textsuperscript{15} 70% were males and 30% females.

In a study by Chung J H et al (2002)\textsuperscript{19} there was almost equal distribution of cases amongst sexes- 27 males and 28 females.

A study by Baradaranfar MH et al(2010)\textsuperscript{10} had more number of males (60.5%) and less number of female (40.5%) patients.

A study by Netkovski J et al(2006)\textsuperscript{126} showed 46 female patients and 34 male patients.

A study by Tilakraj Singh et al (2011)\textsuperscript{11} showed more number of male patients (21) as compared to female patients (09) (Table: 33).

The various studies on CRS show variations in the sex distribution of patients. Some studies show male preponderance and few of the studies show female preponderance. Therefore there is no consensus opinion about sex wise involvement of CRS but there is an inclination towards male preponderance as per the available literature.
Table 33: Sex distribution of CRS patients amongst various studies.

<table>
<thead>
<tr>
<th>Name of author</th>
<th>Year</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chung J H</td>
<td>2002</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>Gupta M et al</td>
<td>2006</td>
<td>66.6%</td>
<td>33.3%</td>
</tr>
<tr>
<td>Chopra H et al</td>
<td>2006</td>
<td>66%</td>
<td>33%</td>
</tr>
<tr>
<td>Netkovski J et al</td>
<td>2006</td>
<td>34</td>
<td>46</td>
</tr>
<tr>
<td>Kim ST et al</td>
<td>2006</td>
<td>70%</td>
<td>30%</td>
</tr>
<tr>
<td>Baradaranfar MH et al</td>
<td>2010</td>
<td>60.5%</td>
<td>40.5%</td>
</tr>
<tr>
<td>Tilakraj Singh and Himani Lade</td>
<td>2011</td>
<td>21</td>
<td>09</td>
</tr>
<tr>
<td>Present Study</td>
<td>2015</td>
<td>65.33%</td>
<td>34.66%</td>
</tr>
</tbody>
</table>

5.1.3 Preoperative symptom comparison:

The preoperative mean symptoms scores in group-A was 8.5±2.46 and in group-B it was 9.3±2.64. No statistical significant difference was observed between group A and group B at preoperative period (p=0.0600). Thus it signifies that both the groups were comparable symptom wise in the preoperative period.

5.1.4 Preoperative CT scan comparison:

The Lund McKay CT total scoring was done for group A and B. On comparing the two groups, they had similar mean scores of both left and right side. The difference between the two groups was statistically not significant (Right side p=0.7920, Left side p=0.2080) implying that both the groups had fair distribution of patients with respect to CT scan scoring.
5.1.5 Preoperative endoscopic score comparison:

Total Lund Kennedy endoscopic scoring of the two groups was done bilaterally. On statistical analysis, they were comparable in terms of endoscopic findings on both right (p=0.7800) and left side (p=0.9290). It means that the preoperative endoscopic scores were similar in both groups.

5.2 Association of CRS and Nasal polyposis (NP)- CRS with and without NP:

In the present study out of 150 patients, 32 (21.33%) had manifested with NP and 118 (78.66%) presented without NP.

A study by Gupta M, et al (2006)\(^\text{17}\) showed 23% of patients had nasal polyps.

A study by Chopra H. et al (2006)\(^\text{114}\) had 62% patients with NP and 38% without NP.

Study by Netkovski et al (2006)\(^\text{126}\) had NP in 45% cases and 55% were cases of CRS without NP.

A study by Baradaranfar MH et al (2011)\(^\text{10}\) showed CRS with NP in 78.4% and 21.6% had CRS without NP.

CRS manifests clinically with NP and without NP. Association of chronic rhinosinusitis with NP shows wide variation and nasal polyposis is one of the manifestations of CRS.

5.3 Operative Procedures / Additional procedures done

Procedures done:

In the present study, uncinectomy was performed in almost all (98.75%) cases to have clear visualization of the area to be operated. The procedures done were middle meatal antrostomy to clear the maxillary disease, anterior ethmoidectomy, total ethmoidectomy, frontal recess and sphenoid clearance.
Discussion

- The most common procedure done was middle meatal antrostomy (MMA) with clearance of maxillary sinus in both groups (96.66% in Group-A and 100% in Group-B respectively) which signifies that maxillary sinus was most commonly involved in CRS. Thus MMA was most common procedure done in 98.33% patients in the present study.

- Total ethmoidal clearance was the second most common procedure to be performed (48.33% in Group-A and 40% in Group-B). The present study shows that total ethmoidal clearance was done in 44.17% of patients.

- Anterior ethmoidal clearance was done in almost equal number of patients (23.33% in Group-A and 21.66% in Group-B). The present study shows anterior ethmoidal clearance was performed in 22.49% of patients.

- The patients with sphenoid sinus clearance were more in Group A (25.83%) than in Group B (20%). In the present study sphenoid sinus clearance was done in 22.92% of patients.

- Frontal sinus was least affected in both the groups. Frontal sinus clearance was done in more no. of patients in Group-A (19.16%) than in Group-B (10%). In the present study frontal sinus clearance was done in 14.58% of patients.

A study by Tilakraj singh et al (2011) showed middle meatal antrostomy and ethmoidectomy were commonly performed procedures (60 in each group). Next in order was sphenoidotomy (30 in one and 20 in another group). Frontal sinus surgery was done in least number of patients (10 in each group).
Discussion

A study by Nair S et al (2011)\textsuperscript{127} showed that uncinectomy and middle meatal antrostomy were the procedures done in all the cases. Other procedures were done according to disease involvement.

In a study by Chopra H et al (2006)\textsuperscript{114} common procedure was total ethmoidectomy (37) followed by anterior ethmoidectomy (10). Sphenoidotomy (08) and frontal sinus surgeries (09) were done in least number of patients.

A study by Netkovski J et al (2006)\textsuperscript{126} showed that uncinectomy with middle meatal antrostomy was the most common performed procedure (90%), followed by anterior ethmoidectomy (63.7%) and total ethmoidectomy (53.7%), frontal sinus surgery in (26.2%) and sphenoidectomy (22.5%).

The above comparison of various studies with the present study reconfirms that in CRS, the maxillary sinus and ethmoid sinuses were commonly involved and accordingly middle meatal antrostomy with maxillary sinus clearance and ethmoidal clearance were most common procedures to be performed. Frontal sinus and sphenoid sinus disease clearance were less performed procedures indicating that frontal and sphenoid sinuses were least affected sinuses in CRS.

Additional procedures done:

The additional procedures were done as per the need of the case during the operative procedure to aid visualization of other areas during FESS.

- In the present study out of 150 patients, septoplasty was done in 62 (41.33%) patients. Septoplasty was performed in 33(44%) patients in group-A and 44 (58.66%) patients in group-B.
• Conchoplasty or middle turbinate resection was done in 73 (48.66%) patients. It was done more in group-B in 44 (58.66%) patients than in group-A-29 (38.66%) patients.

A study by Netkovski J et al (2006)\textsuperscript{126} showed that septoplasty was done in 13.7% patients and partial resection of middle turbinate was done in 22.5% patients.

A study by Murthy P et al (2013)\textsuperscript{128} showed that septoplasty was performed in 71% and turbinate reduction in 9% patients.

In a study by Chopra H et al (2006)\textsuperscript{114} showed septoplasty done in 11 patients. The middle turbinate concha bullosa and paradoxical curved middle turbinate was found in 26% patients, these may require conchoplasty or resection.

A study by Gupta M et al (2006)\textsuperscript{17} showed deviated nasal septum in 30% patients and paradoxical middle turbinate and concha bullosa in 37% of patients. These patients may require septoplasty or conchoplasty or resection.

On comparison of the above studies with the present study, there is variation in the additional procedures performed like septoplasty/conchoplasty/middle turbinate resection. These procedures are basically done to aid visualization of other hidden areas during FESS.
5.4 Objective evaluation: The various endoscopic findings used for objective evaluation were-

- Adhesions (rate of adhesions, grades of adhesions and difference in the rate of adhesions)
- Crusting
- Discharge
- Polypoidal mucosa

5.4.1: Endoscopic findings: Rate of Adhesions-

At last follow up in group-A the rate of adhesions was 5% and in group-B it was 25%. The difference in the rate of adhesions was 20%. On statistical analysis there was a significant difference between the groups (Chi-square=18.8241, p=0.00001).

The rate of adhesions in MMC group in a study by Baradaranfar MH et al (2011)\(^\text{10}\) was 10.8% whereas in studies by Chung et al (2002)\(^\text{19}\) and Gupta M et al (2006)\(^\text{17}\) showed 3.6% and 3% adhesions respectively (Table-34). The other studies showing the beneficial effect of topical MMC were- Kim S T et al (2006)\(^\text{15}\) in their study showed beneficial effect of MMC at 3 months follow-up. Venkatraman V et al (2011)\(^\text{129}\) and Tilakraj Singh et al (2011)\(^\text{11}\) showed decreased incidence of adhesions after topical MMC application in CRS patients. None of the studies mention any side effects or complications related to the topical applications of MMC.
Table-34: The rate of adhesions and the difference in rate of adhesions in various studies

<table>
<thead>
<tr>
<th>Author</th>
<th>Adhesions in cases (MMC)</th>
<th>Adhesion in controls (NS)</th>
<th>Difference in rate of adhesions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chung et al (2002)¹⁹</td>
<td>3.6%</td>
<td>14.5%</td>
<td>11%</td>
</tr>
<tr>
<td>Gupta M et al (2006)¹⁷</td>
<td>3%</td>
<td>37%</td>
<td>34%</td>
</tr>
<tr>
<td>Baradaranfar MH et al (2011)¹⁰</td>
<td>10.8%</td>
<td>27%</td>
<td>16%</td>
</tr>
<tr>
<td>Present study</td>
<td>5%</td>
<td>25%</td>
<td>20%</td>
</tr>
</tbody>
</table>

The present study shows 5% adhesions which was slightly more but comparable with the study by Chung et al¹⁹ and Gupta M et al¹⁷ and it was less when compared to study by Baradaranfar MH et al¹⁰. On comparison the various studies in the literature reveals the beneficial role of topical MMC in reducing the rate of adhesions. All the studies showed that there were no reported side effects and complications related to topical applications of MMC.

5.4.2: Endoscopic findings: Difference in rate of adhesions-

The present study had 25% adhesions in group B and 5% in group A and shows a difference of 20%. The expected difference in the rate of adhesions between the groups was 11% as per the research hypothesis. The observed
difference of 20% was higher than the expected one strengthening the research hypothesis. This signifies the effectiveness of topical MMC.

Various authors like Chung et al (2002)\textsuperscript{19} had shown 14.5% adhesions in controls and 3.6% in cases and the difference was around 11%. Gupta M et al (2006)\textsuperscript{17} had 37% in controls and 3% in cases, the difference being 34%. Baradaranfar MH et al (2011)\textsuperscript{10} had 27% in controls and 10.8% adhesions in cases and the difference was around 16% (Table 34).

There is wide range in difference of rate of adhesions in various studies varies from 11-34% and our value lies in this range and was on the higher side of the range.

**5.4.3: Endoscopic finding-grades of adhesions:**

The grades of adhesions at each follow-up in the present study showed that type C and D were more in group B than group A. The 3\textsuperscript{rd} follow-up showed none of the patients having type B, C or D adhesions but there were type A adhesions in both group A (5%) and group B (25%). There was a gradual shift of from higher to the lower grade of adhesions at each follow-up. The comparative statistical analysis between the groups showed significant difference (p<0.05) at each follow-ups. In group A- 95% did not had adhesions and in group B- 75% did not had adhesions- thus majority of operated sides were free from adhesions.

In a study by Baradaranfar MH et al (2011)\textsuperscript{10} showed 14 adhesions of which-2 were type A, 7 type B, 1 type C and 4 type D and out of these 14 adhesions 1 was severe and rest 13 were mild and without interfering in direction of sinus
Discussion

Drainage. On comparison with the study by Baradaranfar MH et al (2011), our study had less number of type B and C adhesions and more of type A adhesions and this could be attributed to the fact that Baradaranfar MH et al (2011) included revision cases also in their study but revision cases were excluded in the present study.

A study by Chung J H et al had more number (59%) of mild and less number of moderate (18%) and severe (23%) adhesions within 2 months of surgery.


Therefore MMC has role in decreasing the severity of adhesions but meticulous follow-up and proper management of these adhesions is of paramount importance.

5.4.4: Endoscopic finding-Crusting

In group A at last follow up rate of crusting was 1.67% whereas in group B it was 14.17%. The difference between the two groups was found to be of statistically significant (Yates corrected Chi-square=12.8601, p=0.0003). The present study showed progressive decrease in the rate of crusting from 1st to 3rd follow-up.

A study by Gupta M et al (2006) showed 10% crusting on control side and no crusting on MMC side.
Similarly study by Venkatraman V et al (2011)\textsuperscript{129} showed decreased incidence of adverse tissue reaction like crusting on MMC side as compared to normal saline.

Thus, MMC has a role in reducing the incidence of crust formation in the post-operative period after FESS.

5.4.5: Endoscopic finding: Polypoidal mucosa-

At third follow up the polypoidal mucosa was found in 0.83% in group A whereas in group B the finding was 5%. On statistical analysis there was no significant difference between the two groups at last follow-up (Yates corrected, Chi-square=2.3541, \textit{p}=0.1249). The present study showed progressive decrease in polypoidal mucosa finding from 1st to 3rd follow-up. Both groups behaved in the similar manner with respect to endoscopic finding of polypoidal mucosa (Table-12).

A study by Gupta M et al (2006)\textsuperscript{17} showed polypoidal mucosa in 10% cases on control side and 3% cases on MMC side.

Similarly study by Venkatraman V et al (2011)\textsuperscript{129} showed decreased incidence of adverse tissue reaction like polypoidal mucosa on MMC side as compared to normal saline.

Thus, MMC has a role in reducing the incidence of polypoidal mucosa in the post-operative period after FESS as per the above two studies, however the present study did not support this possible role of MMC.
5.4.6: Endoscopic finding: Discharge-

In group A discharge at third follow up was 6.67% whereas in group B it was 17.50%. On statistical analysis there was a significant difference between the two groups at end of third follow-up (Chi-square=6.6291, p=0.0100, Table- 13). The present study showed progressive decrease in the rate of discharge from 1st to 3rd follow-up.

A study by Gupta M et al (2006)\textsuperscript{17} showed rate of discharge in 30% on control side as compared to 7% on MMC side.

Similarly study by Venkatraman V. et al (2011)\textsuperscript{129} showed decreased incidence of adverse tissue reaction like discharge on MMC side as compared to normal saline.

Thus, MMC has a role in reducing the incidence of discharge in the post-operative period after FESS.

5.5 Subjective evaluation was done by

5.5.1 Severity of 4 symptoms- Total symptom score and scores of facial pain/pressure, Nasal obstruction, Nasal discharge and Hyposmia

5.5.2 SNOT total score and four domains of SNOT namely-

Rhinologic, Ear & facial domain, Sleep domain, Psychologic domain

5.5.1.1: Total score:

The present study observed a significant change of 78.56% from pre-operative to post-operative total symptom score in group A and in group B it was 74.93%.

As a whole, the difference between the group A & B with respect to change in
Discussion

total symptom score from pre to post-operative was statistically significant (Z = -1.9151, p=0.0006). The symptomatic improvement found in present study was slightly better in Group-A than in Group-B.

5.5.1.2: Facial pain / pressure:
The group-A showed 86.57% improvement postoperatively and in group-B the improvement was 75.97%. The difference between two group A & group B with respect to improvement in facial pain from pre-operative to post-operative was statistically significant (Z=-4.5650, p=0.00001). The group-A had better improvement in facial pain.

5.5.1.3: Nasal Obstruction:
The group-A showed 79.47% improvement postoperatively and in group-B the improvement was 74.39%. The difference between group A and group B with respect to nasal obstruction from pre-operative to post-operative was statistically significant (Z= -2.5484, p=0.0108). Group-A had better improvement in nasal obstruction.

5.5.1.4: Nasal Discharge/ Ant / Post:
The group-A showed 71.83% improvement postoperatively and in group-B the improvement was 75%. The difference between group A and group B with respect to nasal discharge from pre-operative to post-operative was statistically not significant (Z= -0.6954, p=0.4868). The group-B had better improvement in nasal discharge.

5.5.1.5: Hyposmia:
The group-A showed 22.22% smell improvement postoperatively and in group-B the improvement was 57.14%. The difference between group A and group B with respect to hyposmia from pre-operative to post-operative was statistically
Discussion

not significant (Z= -0.7160, p=0.4740). The group-B had better improvement in hydrasmin than group-A.

A study by Murthy P.et al (2013)\textsuperscript{128} showed the symptoms of facial pain, headache, nasal obstruction, nasal discharge, smell disturbance and overall discomfort improved with statistical significance (p<0.001) but most improved were nasal obstruction and facial pain.

National audit of sinus surgery’s report was published by the Royal College of Surgeons of England, which reported rates of improvement in nasal obstruction of 84% and pain in 75%\textsuperscript{,130,131}

Netkovski J et al (2006)\textsuperscript{126} in their study showed improvement in nasal obstruction in 87%, post nasal discharge in 74.3%, anterior nasal discharge in 70.5%, headache in 59.4% and hyposmia in 58.7% of the patients.

A study by Hemant chopra et al (2006)\textsuperscript{114} showed improvement in all symptoms especially nasal obstruction (83%) and nasal discharge (86%). Overall there was marked improvement of symptoms after FESS in 70% patients.

A study by Venkatraman V et al (2011)\textsuperscript{129} observed statistically significant improvement in nasal obstruction and discharge in MMC side as compared to saline sides.

On comparison of symptomatic improvement of the present study with various other studies (Table no. 35) the most improved symptoms were Nasal Obstruction, Facial Pain and Nasal Discharge and hyposmia was the least improved symptoms.
Table 35: Comparison of symptomatic improvement of the present study with various other studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Nasal Obstruction</th>
<th>Facial Pain</th>
<th>Nasal Discharge (Ant/Post)</th>
<th>Hyposmia</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Audit (1997)</td>
<td>84%</td>
<td>75%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Netkovski et al (2006)</td>
<td>87%</td>
<td>-</td>
<td>Ant- 70.5%</td>
<td>58.7%</td>
</tr>
<tr>
<td>Chopra H. et al (2006)</td>
<td>83%</td>
<td>-</td>
<td>86%</td>
<td>-</td>
</tr>
<tr>
<td>Venkatraman V et al (2013)</td>
<td>Significant Improvement</td>
<td>-</td>
<td>Significant Improvement</td>
<td>-</td>
</tr>
<tr>
<td>Present Study</td>
<td>76.93%</td>
<td>81.27%</td>
<td>73.41%</td>
<td>39.68%</td>
</tr>
</tbody>
</table>

The improvement in nasal obstruction in the present study was better in Group A (79.47%) than in Group B (74.39%). Similarly the facial pain also showed better improvement in Group A (86.6%) than in Group B (76%). But the nasal discharge and hyposmia showed better improvement in Group B than Group A.

Study done by Venkatraman V et al (2013) showed significant improvement in nasal obstruction and nasal discharge as found in the present study.

The symptoms of CRS had remarkable improvement after FESS, signifying the effectiveness of this surgery.
5.5.2: Symptomatic outcome analysis using SNOT-20 and Its four domains:

5.5.2.1: SNOT-20 total score comparison:
In the present study, both group-A and group-B have shown good symptomatic improvement post-operatively in total SNOT score comparison. The percentage improvement observed were 65.19% and 67.34% respectively in group A and group B. The difference between the group A & B with change in SNOT total score from pre to post-operative was statistically significant ($Z= -3.6892, p=0.0002$)

5.5.2.2: Different domains of SNOT-20:
- The rhinologic domain of SNOT showed 64.87% improvement in Group A and 62.24% in Group B. The difference between group A and B with change in rhinologic domain from pre to post-operative period was statistically significant ($Z= -5.4502, p=0.00001$). Thus the group A showed better improvement in rhinologic domain.

- The ear and facial domain of SNOT showed 72.62% improvement in Group B and 69.53% in Group A. The difference between group A and group B with change in ear and facial domain from pre to post-operative period was statistically significant ($Z= -4.5631, p=0.00001$). Group B showed better improvement than group A in this domain.

- The sleep domain of SNOT showed 60.47% improvement in Group A and 60.06% in Group B. The difference between group A and group B with the change in this domain was found to be statistically not significant ($Z= -0.7179, p=0.4728$). Thus both groups showed similar post-operative improvement in sleep domain.

- The psychological domain of SNOT showed 77.70% improvement in Group B and 65.19% in Group A. Further, the difference between group A and
Discussion

group B with the change in psychological domain was found to be statistically not significant (Z= -1.6238, p= 0.1044). Thus, in psychological domain both groups showed similar improvement in postoperative period.

In all four domains of SNOT both groups have shown good symptomatic improvement post-operatively.

A studies by Pynnonen et al (2009)\textsuperscript{13} and Browne JP et al (2007)\textsuperscript{14} have shown that SNOT-20 as most widely used quality of life instruments for sinonasal conditions and validation studies have supported dividing SNOT in four domains namely- rhinologic, ear & facial, sleep and psychological domains. The two constructs (rhinologic, ear & facial domains) address symptoms and two others (sleep and psychological domains) address aspects of health related quality of life. These studies have shown improvement in all the four domains of SNOT and that such patient reported outcome measures are clinically meaningful and scientifically sound and also help clinicians for more effective counseling about quality of life impact after operative intervention. The above 2 studies show effectiveness of FESS in CRS patients and the efficacy of FESS has been established by many other studies with large no of patients.\textsuperscript{128} Other studies by Netkovski et al (2006)\textsuperscript{126}, Chopra H. et al (2006)\textsuperscript{114}, Venkatraman V et al (2013)\textsuperscript{129} revealed significant symptomatic improvement after FESS and its efficacy in CRS patients.

Symptomatically patients show good improvement after FESS in SNOT total score as well as in all the 4 domains of SNOT. Symptomatic outcome analysis using SNOT and it’s four domains will help to understand post-interventional quality of life impact for CRS, will help clinician for effective counseling. FESS is a gold standard procedure for CRS with good efficacy.