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ORIGINAL ARTICLE

Platelet Rich Plasma and Its Role in Endoscopic Sinus Surgery

Mohamedalshawadfy[1], Ramzy Tantawey*[1], MAA EL-AHL[1], Islam R. Herzallah[1]
[1] Otorhinolaryngology Department, Faculty of Medicine, Zagazig University, Egypt

Corresponding author:
Ramzy Tantawey

E-mail:
ramzytantawey@gmail.com

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ABSTRACT

Background: Chronic rhinosinusitis (CRS) poses significant health challenges, requiring comprehensive management strategies including endoscopic sinus surgery (ESS). Platelet-rich plasma (PRP) therapy holds promise in CRS management by promoting tissue repair and regeneration. This work aimed to evaluate PRP's efficacy as adjunctive treatment during ESS for CRS. **Methods:** Prospective controlled double-blinded randomized study at Zagazig University Hospitals. Sample size: 36 patients undergoing bilateral ESS (72 sides). Preoperative assessments included SNOT-22 and Meltzer's Polyp score. PRP was applied in one randomly selected side at the end of ESS, while the other side served as control. Postoperative evaluations using VAS symptom score and endoscopic score were carried at 1 week, 1 month, and 3 months postoperatively **Results:** Baseline data: Mean age 33.39 ± 7.06 years, Lund McKay score 16.06 ± 0.78, Meltzer criteria 2.83 ± 0.73. PRP improved symptoms like nasal blowing, blockage, runny nose, and thick nasal discharge ($p<0.05$) mainly in the short term. One-week post-management, PRP improved mucosal healing ($p=0.0455$) and reduced bleeding and edema ($p<0.05$). One month follow up showed significant differences regarding crustations($p=0.0409$) and edema($p=0.0161$). Three-month evaluation found no significant difference in the outcome criteria with PRP ($p>0.05$). However, adhesion incidence was less in PRP side ($p=0.1643$)
Conclusions: PRP therapy adjunctive to ESS in CRS may offer short-term symptom relief and improved mucosal healing. Further studies are needed to elucidate its long-term efficacy and application.
Keywords: Platelet-rich plasma; Endoscopic sinus surgery; Sinusitis.

INTRODUCTION:

Chronic rhinosinusitis (CRS) is a 12-week nasal sinus and tissue inflammation with serious health risks [1]. Symptoms include congestion, postnasal discharge, face pressure, and smell loss. Untreated CRS may cause orbital cellulitis and abscesses. Allergic rhinitis, asthma, nasal polyps, immunological diseases, and anatomical abnormalities are risk factors [2, 3].Bacterial control, lowering mucosal inflammation, and improving nasal outflow are CRS treatments. In refractory cases such nasal polyposis or allergic fungal rhinosinusitis, gluco-corticosteroids and antibiotics are indicated. If Medical treatment fails, endoscopic sinus surgery (ESS) is recommended [4, 5].ESS is necessary for resistant CRS, however crustation, edema, synechia, and poor healing require revision surgery. Long-term low-dose steroids, nasal steroids, and other antibiotics may reduce recurrence. PRP treatment, which uses platelet growth factors, may help control CRS by enhancing tissue repair and regeneration, wound healing, and postoperative recovery [6-8].The main aim of the study was to evaluate the efficacy and potential benefits of PRP therapy as an adjunctive treatment in ESS for chronic rhinosinusitis.

METHODS

This prospective controlled double-blinded randomized study was conducted at the Otorhinolaryngology Department at Zagazig University Hospitals, in collaboration with the Hematology Unit. The sample size calculation was

based on an estimated mean difference in the outcome measures in the PRP administered sides versus the control sides utilizing Open Epi software. Inclusion criteria: age above 18 years of age, bilateral chronic rhinosinusitis, with or without polyposis, refractory to medical management, and suitable for ESS. Exclusion criteria: unilateral sinonasal pathology, significant asymmetry on CT scans indicated by a Lund McKay score difference greater than 4, and cases of recurrent sinusitis. Additionally, individuals with platelet function disorders, thrombocytopenia, or a history of other comorbidities were excluded, as were those with a high suspicion of nasal malignancy or failing to meet the inclusion criteria.

Informed consent was obtained from each participant and thorough history-taking and physical examinations were done. Assessment of chronic rhinosinusitis severity was carried out using standardized measures. The Sino-nasal Outcome Test (SNOT-22), administered in its validated Arabic version, was utilized for symptom evaluation [9]. Each participant completed the questionnaire during clinic visits, rating symptoms on a scale of 0 to 5, with higher scores indicating more severe symptoms. Preoperative nasal examinations using rigid nasal endoscopes were performed following nasal decongestion and topical anesthesia using a mixture of 4% lidocaine and phenylephrine hydrochloride spray. Nasal endoscopic findings were graded according to Meltzer's criteria [10]. Routine laboratory investigations were also conducted.

PRP were made from autologous whole blood at surgery start. After anticoagulating 20 mL blood, double-spin centrifugation occurred. Red blood cells were separated from the buffy coat and plasma by centrifuging at 150–200g for 10 minutes at room temperature. The top plasma layer was aspirated and centrifuged at 1500–2000 g for 15 minutes forming PRP at the bottom of the tube with a count 4–4.5 times higher than baseline and platelet-poor plasma (PPP) at the top. 2 mL of PRP was obtained and stimulated 45–60 minutes before surgery by administering 10% calcium chloride at 0.1 mL every 0.9 mL plasma.

Multiple sinus diseases were treated with ESS. Multiple steps were needed to access and treat various sinuses. Topical xylometazoline or 1:10000 epinephrine decongestant was used the nasal cavity. Middle meatal polyps were removed to improve lateral nasal wall access.

Retrograde Uncinectomy was done with care to minimize damage to nearby buildings. The maxillary sinus ostium was enlarged via maxillary antrostomy to improve drainage.

Ethmoidectomy was done by removing ethmoid sinus cells from the bulla to the basal lamella to the posterior air cells followed by Sphenoidotomy either transnasally or transethmoidally to reach the sinus.

Ethmoid air cells across the skull base and lamina papyracea were then cleared. Final frontal sinusotomy included dissecting the agger nasi cells to clear the sinus outflow. Mucosal integrity and middle turbinate attachments were protected throughout the treatment to avoid instability.

Under endoscopic vision, 2 mL of PRP was intranasally administered to one cleared middle meatus after surgery. We used a 2-cc syringe with a 30 G needle. However, the control group got a 2-cc normal saline injection. This intervention investigated if PRP may improve surgical outcomes. The gloved merocele spacer in each middle meatus was removed after 3 days.

Patients were followed at 1 week, 1 month, and 3 months postoperatively. The tests compared PRP-treated and untreated nasal sides. Subjective assessment included VAS and SNOT–22 scores. After surgery, endoscopic examination examined mucosal healing, bleeding, crustations, synechiae, and edema.

Ethical code approval: ZU-IRB #10814-24/5-2023

STATISTICAL ANALYSIS:

Data analyzed using SPSS v25.0. Methods: mean ± SD for quantitative, number/percentage for qualitative. Analyzed using t-test (means of 2 groups), Mann-Whitney (non-normally distributed data), Chi-square (association), Z-test (percentage comparison), Odds ratio (risk assessment). Significance level set at 5% ($P < 0.05$=significant).

RESULTS:

The average age was 33.39±7.06 years. 20 (55.56%) were male. 16 (44.44%) of patients lived in urban areas. The mean Lund McKay score was 16.06± 0.7 and the mean Meltzer criteria score was 2.83±0.73 (Table 1).

SNOT-22 score dropped from 68.28 ± 2.22 pre-management to 12.64 ± 2.26 3 months post-management ($p<0.0001$). Nasal blowing reduced from 3.39 ± 0.49 pre-management to 0.78 ± 0.89 after 3 months ($p<0.0001$). Nasal obstruction reduced from 4.42 ± 0.49 pre-management to 0.22 ± 0.42 after 3 months ($p<0.0001$). Sneezing reduced from 2.56 ± 0.5 pre-management to 0.28 ± 0.45 after 3 months ($p<0.0001$). Runny nose reduced from 3.58 ± 0.49 pre-management to 0.28 ± 0.45 after 3 months

(p<0.0001). Mild symptoms rose from 0% pre-management to 100% at 3 months post-management (p<0.0001), whereas moderate symptoms reduced from 100% to 0% (p<0.0001). Participants with significant symptoms reduced from 100% pre-management to 0% after 3 months (p<0.0001) (Table 2).

After 1 week, PRP treatment decreased the need to blow the nose (1.08 ± 0.83 vs. 1.53 ± 0.64 without PRP, p=0.0437), nasal blockage (0.42 ± 0.49 vs. 0.75 ± 0.64 without PRP, p=0.0233), runny nose (0.42 ± 0.49 vs. 0.72 ± 0.61 without PRP, p=0.0343), and thick nasal discharge (0.42 ± 0.49 with PRP vs. 0.72 ± 0.65 without PRP, p=0.0486). After 1 month, PRP significantly reduced the need to blow the nose (0.72 ± 0.73 vs. 1.06 ± 0.66 without PRP, p=0.0447), runny nose (0.19 ± 0.4 vs. 0.42 ± 0.49 without PRP, p=0.0428). After 3 months, there was non-significant difference (Table 3).

After 1 week, PRP improved mucosal healing in 77.78% of individuals compared to 55.56% without PRP (p=0.0455). The PRP group had lower rates of edema (19.44%) and bleeding (16.67%) than the non-PRP group from which 47.22% had edema (p=0.0124), and 50% had bleeding (p=0.0027). The PRP group had considerably lower crustation rates (8.33%) and lesser synechiae development (5.56%) compared to the non-PRP group (41.67%, p < 0.001) and (22.22, p= 0.0409) (Table 4). (Figure 1,2)

After 1 month, Edema incidence was significantly lower in the PRP group (13.89%) than the non-PRP group (38.89%, p=0.0161). Crustations were also considerably lower in the PRP group (5.56%) than in the non-PRP group (22.22%, p=0.0409) (Table 4). (Figure 3, S1). After 3 months, there was non-significant difference (Table 4). (Figure S2,S3)

Table (1): Patients basal characteristics

	Vale (N=36)
Age	33.39±7.06
Sex	
Male	20(55.56%)
Female	16(44.44%)
Residence	
Urban	16(44.44%)
Rural	20(55.56%)
Lund McKay score	16.06±0.78
Meltzer criteria	2.83±0.73

Table (2): SNOT-22 Score evaluation among included subject through the study

	Pre-Management (A)	**1 Week post management (B)**	**1 month post management (C)**	**3 months post management (D)**	**P(f)**
Need to blow nose	3.39±0.49	1.56±0.5	1.14±0.48	0.78±0.89	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0327* ,P5=<0.0001*,P6=0.1259				
Nasal Blockage	4.42±0.49	0.92±0.36	0.44±0.5	0.22±0.42	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0001* ,P5=<0.0001*,P6=0.1629				
Sneezing	2.56±0.5	0.53±0.5	0.28±0.45	0.28±0.45	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.1261 ,P5=0.1261,P6=0.99				
Runny nose	3.58±0.49	0.72±0.61	0.42±0.49	0.28±0.45	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0658 ,P5=0.0023*,P6=0.6705				
Cough	2.69±0.46	1.42±0.49	0.83±0.76	0.75±0.68	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0006*				

	,P5=0.0001*,P6=0.9413				
Post-nasal discharge	3.44±0.5	0.53±0.69	0.36±0.48	0.28±0.45	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.5642 ,P5=0.2119,P6=0.9153				
Thick nasal discharge	3.56±0.5	0.72±0.65	0.42±0.49	0.25±0.43	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0748 ,P5=0.0014*,P6=0.5459				
Ear fullness	2.53±0.5	0.61±0.68	0.31±0.46	0.22±0.42	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0736 ,P5=0.012*,P6=0.9095				
Dizziness	1.5±0.5	0.67±0.47	0.31±0.46	0.31±0.46	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0094* ,P5=0.0094*,P6=0.99				
Ear pain	2.42±0.49	0.61±0.68	0.36±0.71	0.28±0.61	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.3463 ,P5=0.123,P6=0.9451				
Facial pain/pressure	4.5±0.5	0.67±0.67	0.28±0.45	0.22±0.42	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0107* ,P5=0.0025*,P6=0.9696				
Decreased Sense of Smell/Taste	4.58±0.49	1.25±0.89	0.78±1.03	0.67±0.88	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0967 ,P5=0.0239*,P6=0.947				
Difficulty falling asleep	3.42±0.49	2.5±0.5	2.08±0.68	1.58±0.6	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0147* ,P5=<0.0001*,P6=0.0021*				
Wake up at night	3.5±0.5	1.58±0.49	1.03±0.64	0.89±0.52	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0002* ,P5=<0.0001*,P6=0.707				
Lack of a good night's sleep	3.47±0.5	1.5±0.5	1±0.75	0.83±0.6	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0033* ,P5=<0.0001*,P6=0.6456				
Wake up tired	3.56±0.5	1.58±0.49	1.17±0.69	1±0.58	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0139* ,P5=0.0002*,P6=0.612				
Fatigue	3.58±0.49	2.44±0.5	2.08±0.64	1.69±0.66	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.048* ,P5=<0.0001*,P6=0.0281*				
Reduced productivity	3.56±0.5	1.53±0.5	0.94±0.74	0.89±0.7	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0007* ,P5=0.0002*,P6=0.9819				
Reduced concentration	2.5±0.5	0.31±0.46	0.17±0.37	0.17±0.37	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.5323 ,P5=0.5323,P6=0.99				
Frustrated/restless/irritable	2.5±0.5	1.33±0.47	0.89±0.7	0.78±0.58	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.0075* ,P5=0.0004*,P6=0.8471				
Sad	1.5±0.5	0.28±0.45	0.17±0.37	0.17±0.37	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.6967 ,P5=0.6967,P6=0.99				
Embarrassed	1.53±0.5	0.19±0.4	0.11±0.31	0.11±0.31	<0.0001*

	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=0.8061 ,P5=0.8061,P6=0.99				
Total Score	68.28±2.22	23.44±2.3	15.56±2.39	12.64±2.26	<0.0001*
	P1=<0.0001*,P2=<0.0001*,P3=<0.0001*,P4=<0.0001* ,P5=<0.0001*,P6=<0.0001*				
Mild (0-20)	0(0%)	3(8.33%)	36(100%)	36(100%)	<0.0001*
Moderate (21-40)	0(0%)	33(91.67%)	0(0%)	0(0%)	<0.0001*
Severe (>40)	36(100%)	0(0%)	0(0%)	0(0%)	<0.0001*

P1: Group A Vs. B, P2: Group A Vs. C, P3: Group A Vs. D, P4: Group B Vs. C, P5: Group B Vs. D, P6: Group C Vs. D

Table (3): VAS Symptom Score post management evaluation

	With PRP (N=36)	**Without PRP (N=36)**	**P. Value**
1 week			
Need to blow nose	1.08±0.83	1.53±0.64	0.0437*
Nasal Blockage	0.42±0.49	0.75±0.64	0.0233*
Runny nose	0.42±0.49	0.72±0.61	0.0343*
Thick nasal discharge	0.42±0.49	0.72±0.65	0.0486*
Ear fullness	0.33±0.47	0.61±0.68	0.0882
Ear pain	0.36±0.67	0.61±0.68	0.0596
Facial pain/pressure	0.47±0.5	0.67±0.67	0.2672
1 month			
Need to blow nose	0.72±0.73	1.06±0.66	0.0447*
Nasal Blockage	0.14±0.35	0.33±0.47	0.0547
Runny nose	0.19±0.4	0.42±0.49	0.0428*
Thick nasal discharge	0.22±0.42	0.42±0.49	0.0801
Ear fullness	0.19±0.4	0.31±0.46	0.283
Ear pain	0.25±0.6	0.36±0.71	0.422
Facial pain/pressure	0.19±0.4	0.28±0.45	0.4128
3 months			
Need to blow nose	0.69±0.7	0.75±0.83	0.9314
Nasal Blockage	0.14±0.35	0.22±0.42	0.3658
Runny nose	0.19±0.4	0.28±0.45	0.4128
Thick nasal discharge	0.22±0.42	0.25±0.43	0.7888
Ear fullness	0.19±0.4	0.22±0.42	0.7794
Ear pain	0.19±0.46	0.28±0.61	0.572
Facial pain/pressure	0.19±0.4	0.22±0.42	0.7794

Table (4): Follow up assessment post management

	With PRP (N=36)	**Without PRP (N=36)**	**P. Value**
1 week			
Mucosal good healing	28(77.78%)	20(55.56%)	0.0455*
Edema	7(19.44%)	17(47.22%)	0.0124*
Bleeding	6(16.67%)	18(50%)	0.0027*
Crustations	3(8.33%)	15(41.67%)	<0.001*
Synechiae formation	2(5.56%)	8(22.22%)	0.0409*
1 month			
Mucosal good healing	31(86.11%)	26(72.22%)	0.1468

	With PRP (N=36)	Without PRP (N=36)	P. Value
Edema	5(13.89%)	14(38.89%)	0.0161*
Bleeding	5(13.89%)	10(27.78%)	0.1468
Crustations	2(5.56%)	8(22.22%)	0.0409*
Synechiae formation	1(2.78%)	5(13.89%)	0.0881
3 months			
Mucosal good healing	35(97.22%)	33(91.67%)	0.3034
Edema	2(5.56%)	6(16.67%)	0.1336
Bleeding	1(2.78%)	3(8.33%)	0.3035
Crustations	1(2.78%)	2(5.56%)	0.555
Synechiae formation	1(2.78%)	4(11.11%)	0.1643

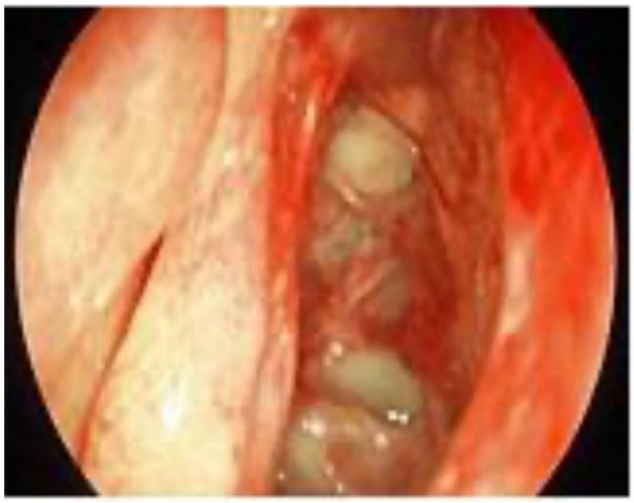

Figure (1): 1-week postoperative left side with PRP

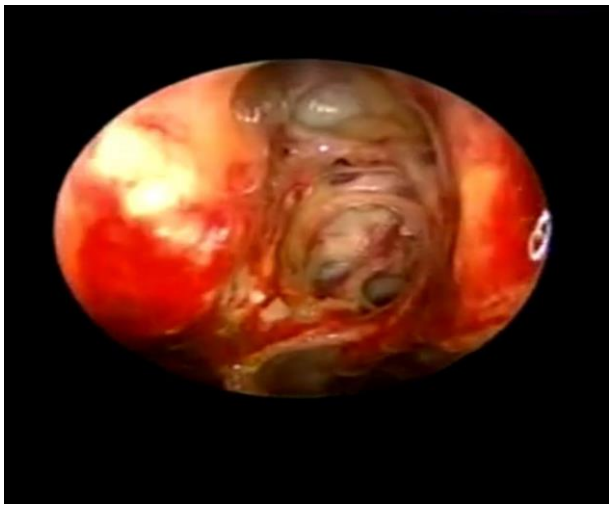

Figure (2): 1 week postoperative right side No PRP

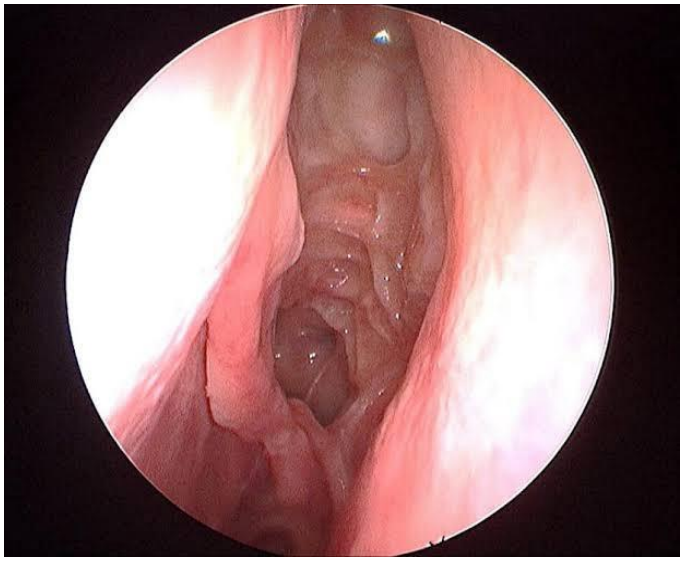

Figure (3): 1-month postoperative left side with PRP

DISCUSSION:

Our cohort was similar to Mohebbi, Hosseinzadeh [10] with a mean age of 36.55 years among 21 patients. Goljanian Tabrizi, Asadi [11] revealed a mean age of 35.96 years, with minimal differences between intervention and control groups (37.15 and 34.43 years).

Our study contained more males (55.56%) than females (44.44%), like Hassan, Ibrahim [12], who had 18 males and 22 females in 40 cases. With 48 participants, Goljanian Tabrizi, Asadi [11] observed a larger male proportion (70.8%).

Furthermore, our study found an average Lund McKay score of 16, which was consistent with Mohebbi, Hosseinzadeh [10] reporting a median Lund-McKay of 10 (9.5-11) before treatment. However, Goljanian Tabrizi, Asadi [11] noted a slightly higher mean Lund–Mackay score of 20.04.

Our study found decreasing SNOT-22 scores across all criteria pre- and post-management. The urge to blow nose, nasal blockage, runny nose, and others improved significantly. This was consistent with Mohebbi, Hosseinzadeh [10]. Significant improvements were observed in blowing nose, nasal obstruction, sneezing, runny nose, cough, and postnasal drip (PND) ($p < 0.05$), supporting our study findings.

Our VAS symptom Score at follow-up showed significant differences between PRP-treated and non-treated sides in nasal blockage, runny nose, thick nasal discharge, or urge to blow nose in the early postoperative period. These findings complement Dinaki, Grigoriadis (126), who showed reduced VAS scores in the PRP group. This suggests that PRP may reduce postoperative symptoms.

The intervention group in Dinaki, Grigoriadis [13] consistently had lower VAS scores than controls, with a significant reduction at 4 weeks post-operation ($p < 0.005$). In patients treated with PRP, Mostafa and Ayad [14] found endoscopic improvement and symptom reduction in nasal crusts (92.30%), foetor (79.48%), nasal obstruction (76.92%), and anosmia (43.58%). After PRP injection, nasal crusts (23.07%), foetor (33.33%), nasal blockage (35.89%), and anosmia (33.33%) decreased.

Kumar [15] observed that PRP post-septoplasty considerably enhanced nasal mucociliary clearance (NMC) compared to controls, supporting our findings. This supports the efficacy of PRP therapy in treating chronic rhinosinusitis.

Hassan, Ibrahim [12] compared postoperative pain and nasal obstruction scores one week after surgery. The PRP group had considerably lower mean pain scores than the contralateral side group (2.75 vs. 3.98, $p=0.024$). However, there was no significant change in NOSE score between PRP and contralateral side groups (1.50 vs. 2.25, $p=0.233$).

Our study found mixed postoperative recovery and problems after one week and one month of PRP therapy. PRP-treated patients had lower incidences of edema and crustations than non-PRP sides at both time periods, although mucosal healing was much higher at one week. After three months, PRP-treated and non-PRP-treated groups had similar postoperative outcomes.

Kumar [15] found lower crust development in the PRP-treated group post-septoplasty, supporting our findings that nasal mucociliary clearance function may improve and speed nasal function recovery. Kuzucu, Beriat [16] observed that PRP decreased postoperative hemorrhage and crustations development after one month, similar to our investigation.

Our findings are consistent with Salaheldin and Hussein [17], who found reduced crust formation, hemorrhage, and nasal mucociliary clearance in the PRP group after submucous diathermy. However, Rice [18] showed no advantage of PRP on mucosal healing in endoscopic sinus surgery (ESS) compared to control sides in bilateral chronic rhinosinusitis patients. This disagreement may be attributed to the small sample size.

To investigate synechiae development after PRP treatment, we followed up at 1 week, 1 month, and 3 months. Synechiae development was significantly lower in the PRP group at 1 week (5.56% vs. 36.11%, $p=0.0011$*). Synechiae formation decreased in both groups at 1-month post-management, although the PRP group had a lower rate (2.78% vs. 13.89%, $p=0.0904$). The 3-month follow-up showed little advantage for the PRP group (2.78% vs. 5.56%, $p=0.5618$), perhaps owing to the small sample size. However, the reduction in synechiae development, especially early postoperatively, implies that PRP treatment may reduce it.

CONCLUSIONS:

PRP treatment may help chronic rhinosinusitis ESS, according to our study. PRP may reduce postoperative symptoms, since we noticed significant decreases in blowing nose, nasal blockage, and runny nose in the early postoperative period. PRP therapy's long-term effects fade with time, highlighting the need for further research on its

efficacy and application. PRP treatment reduced synechia development, although the effect was not statistically significant owing to limited sample size. Despite these limitations, our findings imply that PRP therapy may improve chronic rhinosinusitis surgical outcomes, warranting additional study.

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Author Consent and Conflict of interest

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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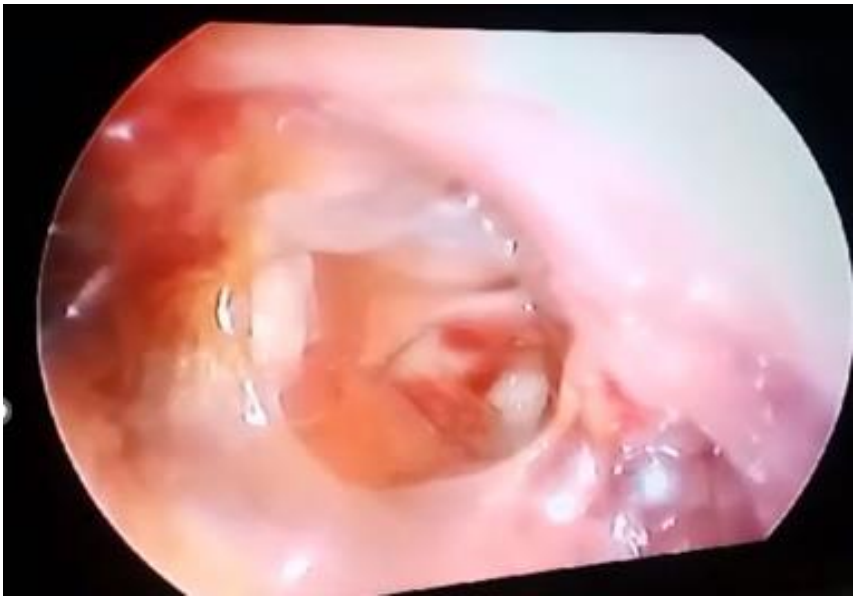

Figure (S1): 1-month postoperative Rt side no PRP

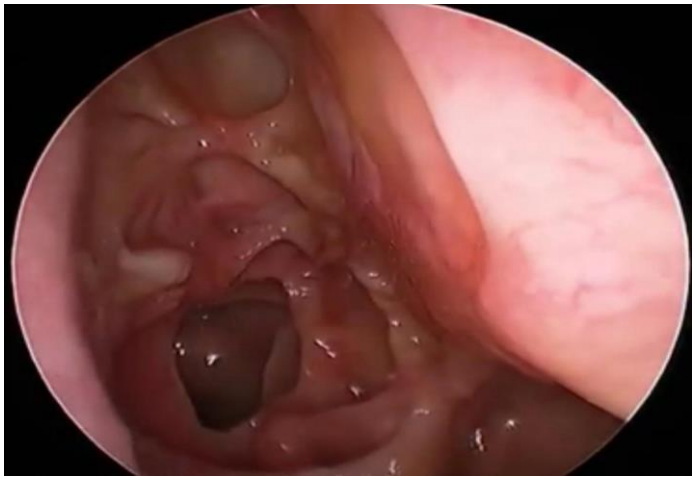

Figure (S2): 3 months postoperative left side with PRP

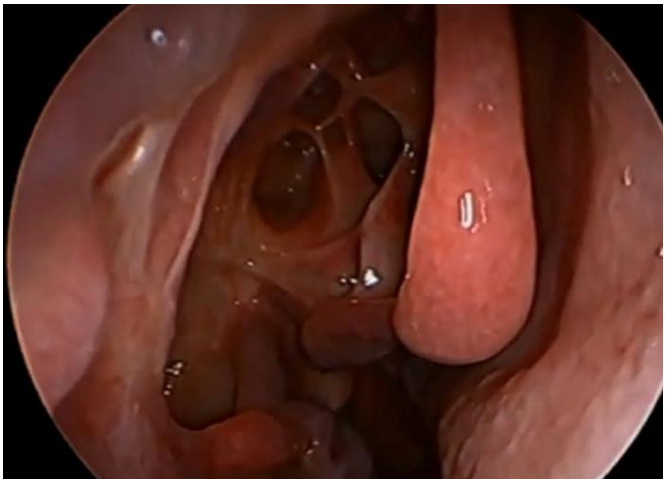

Figure (S3): 3 months postoperative right side no PRP

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