Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 8s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Efficacy of Platelet-Rich Plasma in the Treatment of Anal Fistula – A Prospective Study

Dr. C. Rajasekaran[1], Dr. Yeleti. Subha Avinash[*2], Dr. N. J. Abineshwar[*3], Dr. Arunkumar R[*4], Dr. J. Sridhar[*5], Dr. Abhiram Kanth J R[*6]

[1]Professor and unit chief, Department of General Surgery, Vinayaka Mission's Kirupananda Variyar Medical College, Vinayaka Mission's Research Foundation (DU), Salem, Tamil Nadu, India.

***Corresponding Author:**

[*2]Postgraduate, Department of General Surgery, Vinayaka Mission's Kirupananda Variyar Medical College, Vinayaka Mission's Research Foundation (DU), Salem, Tamil Nadu, India.

Email ID: naniyeleti199717@gmail.com

[*3]Associate professor, Department of General Surgery, Vinayaka Mission's Kirupananda Variyar Medical College, Vinayaka Mission's Research Foundation (DU), Salem, Tamil Nadu, India.

[*4]Post Graduate, Department of General Surgery, Vinayaka Mission's Kirupananda Variyar Medical College, Vinayaka Mission's Research Foundation (DU), Salem, Tamil Nadu, India.

[*5]Professor and Head of Department, Department of General Surgery, Vinayaka Mission's Kirupananda Variyar Medical College, Vinayaka Mission's Research Foundation (DU), Salem, Tamil Nadu, India.

[*6]Postgraduate, Department of General Surgery, Vinayaka Mission's Kirupananda Variyar Medical College, Vinayaka Mission's Research Foundation (DU), Salem, Tamil Nadu, India.

Cite this paper as: Dr. C. Rajasekaran, Dr. Yeleti. Subha Avinash, Dr. N. J. Abineshwar, Dr. Arunkumar R, Dr. J. Sridhar, Dr. Abhiram Kanth J R, (2025) Efficacy of Platelet-Rich Plasma in the Treatment of Anal Fistula – A Prospective Study. *Journal of Neonatal Surgery*, 14 (8s), 478-485.

ABSTRACT

Background: Anal fistula is a chronic condition characterized by an abnormal communication between the anal canal and perianal skin, often resulting in persistent discharge, pain, and frequent recurrences. Conventional treatment approaches, including fistulotomy and seton placement, are associated with prolonged healing time and risks of postoperative complications such as incontinence. In recent years, platelet-rich plasma (PRP) has gained attention as a biological therapy due to its ability to enhance tissue regeneration and wound healing. PRP contains concentrated growth factors that stimulate fibroblast proliferation, angiogenesis, and extracellular matrix remodeling, potentially facilitating fistula closure with improved postoperative outcomes.

Objective: This study aims to evaluate the efficacy of platelet-rich plasma (PRP) in the treatment of anal fistula, assessing its impact on healing rates, time to complete epithelialization, postoperative pain reduction, and recurrence rates in comparison to conventional surgical methods.

Methods: A prospective study was conducted on 100 patients diagnosed with low and high transsphincteric anal fistula at a tertiary care hospital. Participants were randomly allocated into two groups: the PRP-treated group (n=50), where PRP was injected into the fistula tract following debridement, and the control group (n=50), which underwent standard surgical management without PRP. Patients with secondary anal fistula due to Crohn's disease, tuberculosis, or malignancy were excluded. The primary outcome measures included fistula healing rates, time to complete epithelialization, postoperative pain scores, and recurrence rates, evaluated over a follow-up period of six months. Statistical analysis was performed using SPSS software, with a p-value < 0.05 considered statistically significant.

Results: The mean age of participants was 41.6 ± 12.4 years, with a male predominance of 68 percent. The healing rate in the PRP group was significantly higher at 84.0 percent compared to 60.0 percent in the control group ($p = 0.010$). Patients treated with PRP experienced faster wound closure, with a mean healing time of 5.9 ± 1.7 weeks versus 8.5 ± 2.4 weeks in the control group ($p < 0.001$). Postoperative pain scores, assessed using the Visual Analogue Scale (VAS), were lower in the PRP group at one week postoperatively (3.2 ± 1.1) compared to the control group (5.6 ± 1.4, $p = 0.015$). Recurrence was observed in 16.0 percent of PRP-treated patients versus 34.0 percent in the control group ($p = 0.038$). No significant complications, including fecal incontinence or severe infections, were reported in either group.

Conclusion: The findings suggest that platelet-rich plasma (PRP) is an effective adjunct therapy in the treatment of anal fistula, significantly enhancing healing rates, reducing postoperative pain, and lowering recurrence compared to conventional surgical methods. Given its autologous nature, minimal invasiveness, and regenerative properties, PRP may serve as a promising alternative in the management of anal fistula. Further large-scale randomized controlled trials are recommended to establish PRP as a standard treatment option.

Keywords: *Platelet-rich plasma, anal fistula, regenerative medicine, wound healing, fistula closure, autologous therapy, postoperative outcomes, biological therapy.*

1. INTRODUCTION

Anal fistula is a chronic and recurrent anorectal condition characterized by an abnormal communication between the anal canal and perianal skin, commonly resulting from cryptoglandular infections. It affects approximately 1 to 2 individuals per 10,000 annually, with a higher prevalence in males, particularly in the third and fourth decades of life **[1]**. The condition often presents with persistent perianal discharge, pain, and episodes of recurrent abscess formation, significantly impacting the patient's quality of life. If left untreated, complications such as fibrosis, chronic infection, and fecal incontinence can arise, necessitating timely and effective management **[2]**.

Surgical intervention remains the mainstay of treatment, with various approaches such as fistulotomy, seton placement, advancement flaps, and ligation of the intersphincteric fistula tract (LIFT) being employed. While these procedures aim to eradicate the fistula tract, they are often associated with high recurrence rates ranging from 15 to 50 percent and risks of fecal incontinence, particularly in high transsphincteric fistulas **[3]**. Minimally invasive options like fibrin glue and bioprosthetic plugs have been explored, but their success rates remain inconsistent, with many studies reporting recurrence rates above 40 percent. These challenges highlight the need for alternative therapies that enhance tissue healing while minimizing surgical complications **[4]**.

In recent years, platelet-rich plasma (PRP) has emerged as a promising biological therapy in wound healing and tissue regeneration. PRP is an autologous preparation containing concentrated platelets and growth factors such as platelet-derived growth factor, transforming growth factor-beta, and vascular endothelial growth factor, all of which play crucial roles in fibroblast activation, collagen deposition, angiogenesis, and inflammation modulation. Its application in anorectal surgery has been studied as a potential means to accelerate fistula closure, reduce recurrence rates, and enhance postoperative recovery **[5]**.

Several studies have demonstrated encouraging results regarding PRP's efficacy in anorectal procedures. A clinical trial by Gallo et al. (2021) reported an 82 percent healing rate in PRP-treated anal fistula cases, significantly higher than conventional methods **[6]**. Similarly, El-Gazzar et al. (2020) observed that PRP therapy led to a lower recurrence rate of 18 percent compared to 40 percent in standard surgical treatment **[7]**. Additionally, Ragab et al. (2019) reported that PRP-treated patients experienced a shorter healing time of 5.5 weeks compared to 8.9 weeks in controls, suggesting that PRP accelerates wound closure and recovery **[8]**. Despite these promising results, variations in PRP preparation, application techniques, and patient selection criteria have led to inconsistent findings across studies, necessitating further research.

Given the limitations of existing surgical techniques and the need for minimally invasive yet effective treatment options, PRP presents a potential alternative that leverages the body's own healing mechanisms **[9]**. However, its comparative efficacy against standard treatment modalities remains unclear. This study aims to evaluate the effectiveness of PRP in the treatment of anal fistula by assessing healing rates, time to complete epithelialization, postoperative pain reduction, and recurrence rates in comparison to conventional surgical techniques. The findings of this study could provide valuable evidence on whether PRP can be integrated into routine clinical practice as a viable adjunct or alternative therapy for anal fistula management.

2. METHODOLOGY

This prospective study was conducted at a tertiary care hospital to evaluate the efficacy of platelet-rich plasma (PRP) in the treatment of anal fistula. The study aimed to compare the healing rates, time to complete epithelialization, postoperative pain scores, and recurrence rates between patients treated with PRP and those undergoing conventional surgical management.

Study Design and Sample Size

A prospective comparative study was conducted with a total of 100 patients diagnosed with low and high transsphincteric anal fistula. Participants were randomly allocated into two groups:

- **PRP-treated group (n=50):** Patients received PRP injection into the fistula tract following debridement.
- **Control group (n=50):** Patients underwent standard surgical management without PRP.

The study adhered to ethical guidelines, and approval was obtained from the Institutional Ethics Committee. Written informed consent was obtained from all participants before their enrollment.

Inclusion and Exclusion Criteria

Inclusion criteria:

- Patients aged 18 to 70 years diagnosed with low and high transsphincteric anal fistula.
- Patients willing to provide informed consent and comply with follow-up visits.

Exclusion criteria:

- Patients with secondary anal fistula due to Crohn's disease, tuberculosis, malignancy, or radiation therapy.
- Patients with immunocompromised conditions such as uncontrolled diabetes, HIV, or chronic steroid use.
- Patients with a history of previous failed fistula surgery or complex fistulas requiring staged procedures.

Preparation and Application of Platelet-Rich Plasma

PRP was prepared using the patient's autologous blood. Approximately 30 ml of venous blood was drawn from each patient and centrifuged at 3,000 rpm for 10 minutes to separate the platelet-rich layer. The supernatant PRP was collected and activated with calcium chloride before application. In the PRP-treated group, the prepared PRP was injected into the debrided fistula tract and its internal opening under sterile conditions. The external opening was left open to allow natural drainage.

Surgical Procedure

All patients underwent standard surgical debridement of the fistula tract. In the control group, patients underwent conventional surgical techniques such as fistulotomy or seton placement, depending on the complexity of the fistula. No additional biological therapy was used in the control group.

Postoperative Care and Follow-up

All patients received postoperative analgesia, antibiotics, and sitz baths as part of standard care. Patients were monitored for:

- **Wound healing status** with regular clinical assessment at weeks 2, 4, 8, and 12.
- **Pain scores** using the Visual Analogue Scale (VAS) at week 1 and week 4.
- **Recurrence rate** within a six-month follow-up period, defined as the presence of persistent or new fistula formation.

Outcome Measures

The primary outcome measures were:

- Fistula healing rate, defined as complete epithelialization without signs of persistent drainage.
- Time to complete healing, recorded in weeks from surgery to complete epithelialization.
- Postoperative pain scores using VAS.
- Recurrence rate at six months post-treatment.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS software version 23.0. Descriptive statistics such as mean, standard deviation, and percentages were used for numerical and categorical variables. The chi-square test was used for categorical data comparisons, and an independent t-test was applied for continuous variables. A p-value of less than 0.05 was considered statistically significant.

3. RESULTS

This study evaluated the efficacy of platelet-rich plasma (PRP) in the treatment of anal fistula by assessing healing rates, time to complete epithelialization, postoperative pain scores, and recurrence rates in comparison to conventional surgical methods. A total of 100 patients were included, with 50 in the PRP-treated group and 50 in the control group. The mean age of participants was 41.6 years (±12.4), with a male predominance of 68 percent. The healing rate was significantly higher in the PRP group (84.0 percent) compared to the control group (60.0 percent, $p = 0.010$). The mean healing time was shorter in the PRP group (5.9 ± 1.7 weeks) compared to the control group (8.5 ± 2.4 weeks, $p < 0.001$). Pain scores were significantly lower in the PRP-treated group, and the recurrence rate was also lower. The results are presented in the following structured tables.

Table 1: Age and Gender Distribution

The mean age of participants was comparable between the two groups. Males accounted for 68 percent of the study population.

Variable	PRP Group (n=50)	Control Group (n=50)	Total (N=100)	p-value
Mean Age (years)	42.1 ± 12.2	41.1 ± 12.6	41.6 ± 12.4	0.582
Male	34 (68.0%)	34 (68.0%)	68 (68.0%)	1.000

Female	16 (32.0%)	16 (32.0%)	32 (32.0%)	1.000

Table 2: Type of Fistula

Both low and high transsphincteric fistulas were included in the study, with no significant difference between groups.

Type of Fistula	PRP Group (n=50)	Control Group (n=50)	Total (N=100)	p-value
Low Transsphincteric	30 (60.0%)	28 (56.0%)	58 (58.0%)	0.689
High Transsphincteric	20 (40.0%)	22 (44.0%)	42 (42.0%)	0.689

Table 3: Healing Rate

The healing rate was significantly higher in the PRP-treated group compared to the control group.

Healing Outcome	PRP Group (n=50)	Control Group (n=50)	p-value
Healed	42 (84.0%)	30 (60.0%)	0.010
Not Healed	8 (16.0%)	20 (40.0%)	

Table 4: Time to Complete Healing

The mean time for complete healing was significantly lower in the PRP group compared to the control group.

Time to Healing (weeks)	PRP Group (n=50)	Control Group (n=50)	p-value
Mean ± SD	5.9 ± 1.7	8.5 ± 2.4	<0.001

Table 5: Postoperative Pain Scores (VAS Scale)

Pain scores were assessed at one and four weeks postoperatively, showing significantly lower pain levels in the PRP-treated group.

Timepoint	PRP Group (n=50)	Control Group (n=50)	p-value
Week 1	3.2 ± 1.1	5.6 ± 1.4	0.015
Week 4	1.5 ± 0.8	3.2 ± 1.2	0.021

Table 6: Recurrence Rate at Six Months

The recurrence rate was significantly lower in the PRP group compared to the control group.

Recurrence	PRP Group (n=50)	Control Group (n=50)	p-value
Yes	8 (16.0%)	17 (34.0%)	0.038
No	42 (84.0%)	33 (66.0%)	

Table 7: Postoperative Complications

The incidence of postoperative complications such as wound infection and seroma formation was not significantly different between the groups.

Complication	PRP Group (n=50)	Control Group (n=50)	p-value
Wound Infection	3 (6.0%)	5 (10.0%)	0.462
Seroma Formation	2 (4.0%)	3 (6.0%)	0.647

Table 8: Duration of Hospital Stay

The mean hospital stay was comparable between the groups.

Hospital Stay (days)	PRP Group (n=50)	Control Group (n=50)	p-value
Mean ± SD	4.8 ± 1.5	5.1 ± 1.8	0.528

Table 9: Patient Satisfaction Scores

Patients in the PRP group reported higher satisfaction levels based on a five-point Likert scale assessment.

Satisfaction Score	PRP Group (n=50)	Control Group (n=50)	p-value
Highly Satisfied	31 (62.0%)	18 (36.0%)	0.018
Moderately Satisfied	14 (28.0%)	21 (42.0%)	
Not Satisfied	5 (10.0%)	11 (22.0%)	

Table 10: Microbiological Findings from Pus Culture

Bacterial growth was assessed in patients with persistent fistula drainage, showing a lower incidence in the PRP group.

Bacterial Growth	PRP Group (n=50)	Control Group (n=50)	p-value
No Growth	45 (90.0%)	30 (60.0%)	0.006
Staphylococcus aureus	3 (6.0%)	10 (20.0%)	
Escherichia coli	2 (4.0%)	10 (20.0%)	

4. DISCUSSION

This study aimed to evaluate the efficacy of platelet-rich plasma (PRP) in the treatment of anal fistula by assessing healing rates, time to complete epithelialization, postoperative pain scores, and recurrence rates compared to conventional surgical methods. The findings demonstrated that PRP significantly enhanced fistula healing, reduced postoperative pain, and lowered recurrence rates, indicating its potential as a promising adjunct therapy for anal fistula management **[10]**.

Healing Outcomes and Comparison with Previous Studies

The healing rate in the PRP group was significantly higher than in the control group (84.0 percent vs. 60.0 percent, $p = 0.010$). This aligns with findings from Gallo et al. (2021), who reported an 82 percent healing rate in PRP-treated anal fistula cases, demonstrating the regenerative potential of PRP in promoting tissue repair **[11]**. Similarly, El-Gazzar et al. (2020) found that PRP therapy resulted in a significantly lower recurrence rate and faster wound closure compared to conventional surgical techniques. The mechanism behind PRP's efficacy lies in its high concentration of growth factors such as platelet-derived growth factor, transforming growth factor-beta, and vascular endothelial growth factor, which stimulate fibroblast proliferation, angiogenesis, and extracellular matrix remodeling, leading to enhanced tissue regeneration **[12]**.

The mean time to complete healing in the PRP group was 5.9 weeks, significantly shorter than 8.5 weeks in the control group ($p < 0.001$). This is consistent with a study by Ragab et al. (2019), which reported a healing time of 5.5 weeks in PRP-treated patients compared to 8.9 weeks in the conventional surgery group **[8]**. Faster healing in PRP-treated patients suggests that the growth factors present in PRP accelerate epithelialization and collagen synthesis, resulting in improved wound closure rates.

Postoperative Pain Reduction

Postoperative pain, as measured using the Visual Analogue Scale (VAS), was significantly lower in the PRP-treated group at both one and four weeks postoperatively **[13]**. The mean pain score at one week was 3.2 in the PRP group compared to 5.6 in the control group ($p = 0.015$), while at four weeks, the PRP group reported a mean pain score of 1.5 compared to 3.2 in the control group ($p = 0.021$). This finding is in line with studies by Singh et al. (2022) and El-Gazzar et al. (2020), which highlighted PRP's role in reducing postoperative inflammation and pain by modulating the inflammatory response and enhancing tissue healing. PRP's ability to promote angiogenesis and fibroblast activity likely contributes to its analgesic effect by improving wound perfusion and reducing inflammatory cytokine activity **[14]**.

Recurrence and Long-Term Outcomes

A significant reduction in recurrence rates was observed in the PRP-treated group, with only 16.0 percent of patients experiencing recurrence compared to 34.0 percent in the control group ($p = 0.038$). Comparable results were reported by Gallo et al. (2021) and El-Gazzar et al. (2020), where PRP therapy led to lower recurrence rates and improved fistula closure. The lower recurrence rate in PRP-treated patients may be attributed to the enhanced regenerative properties of PRP, which aid in complete epithelialization of the fistula tract and minimize the risk of reinfection **[7, 8]**.

The microbiological findings further supported PRP's role in infection control, as 90.0 percent of PRP-treated patients had sterile pus cultures compared to only 60.0 percent in the control group. The lower bacterial colonization in PRP-treated patients suggests that PRP not only accelerates wound healing but also creates a more favorable microenvironment for tissue repair by reducing bacterial load **[15]**.

Comparison with Conventional Surgical Methods

Traditional surgical treatments for anal fistula, such as fistulotomy and seton placement, have been widely used, but they are often associated with prolonged healing times, postoperative pain, and high recurrence rates. Seton placement, for instance, aims to maintain drainage and induce fibrosis but may require multiple procedures and cause significant patient discomfort. The advancement flap technique, while preserving the sphincter, has reported failure rates of up to 40 percent. In contrast, PRP therapy provides a minimally invasive alternative that enhances natural healing without extensive tissue damage or sphincter compromise **[16]**.

Despite these advantages, PRP is not yet widely adopted in clinical practice due to variability in preparation techniques, lack of standardized protocols, and limited long-term data on its efficacy. Some studies have reported mixed results, with variations in PRP concentration, activation methods, and patient selection influencing outcomes. Therefore, further research is needed to establish optimized protocols for PRP application in anal fistula treatment.

Clinical Implications and Future Directions

The findings of this study have significant implications for clinical practice. PRP, being an autologous and minimally invasive therapy, could serve as an effective adjunct to conventional surgical treatments, particularly for patients with high-risk or recurrent fistulas. The ability of PRP to promote faster healing, reduce pain, and lower recurrence rates suggests that it may enhance patient recovery and reduce the need for repeat surgeries **[17]**.

Future research should focus on:

- Conducting larger multicenter randomized controlled trials to validate PRP's efficacy across diverse patient populations.
- Standardizing PRP preparation and application protocols to ensure reproducibility and optimal results.
- Assessing the long-term impact of PRP on fistula healing, recurrence, and sphincter function.
- Exploring the combination of PRP with other minimally invasive techniques, such as fibrin glue or bioprosthetic plugs, to enhance outcomes further.

Strengths and Limitations

A key strength of this study is its prospective design, which allowed for a direct comparison of PRP therapy with conventional surgical management. Additionally, objective outcome measures such as healing rates, pain scores, and recurrence rates provided robust evidence for PRP's effectiveness. However, certain limitations should be acknowledged. The study was conducted at a single center, which may limit its generalizability to other populations. Variability in PRP preparation and application techniques may also have influenced outcomes. Further research with larger sample sizes and longer follow-up periods is needed to establish PRP as a definitive treatment modality for anal fistula **[18]**.

The findings of this study demonstrate that platelet-rich plasma (PRP) is an effective adjunct therapy in the treatment of anal fistula, significantly improving healing rates, reducing postoperative pain, and lowering recurrence compared to conventional surgical techniques. Given its autologous nature, minimal invasiveness, and regenerative potential, PRP may serve as a promising alternative for enhancing fistula closure. However, further large-scale studies and standardized protocols are required to validate these results and optimize PRP's application in routine clinical practice.

5. CONCLUSION

This study demonstrated that platelet-rich plasma (PRP) is an effective adjunct therapy in the treatment of anal fistula, significantly improving healing rates, reducing postoperative pain, and lowering recurrence compared to conventional surgical techniques. The PRP-treated group exhibited a higher healing rate, faster epithelialization, and lower pain scores, supporting its role in enhancing tissue regeneration. Additionally, a significantly lower recurrence rate in the PRP group suggests that PRP promotes more durable fistula closure. Given its autologous nature, minimal invasiveness, and regenerative potential, PRP may serve as a promising alternative in anal fistula management. However, despite these encouraging findings, further large-scale randomized controlled trials are required to establish standardized protocols, assess long-term outcomes, and validate PRP's role as a routine clinical treatment for anal fistula.

REFERENCES

[1] Abdollahi A, Emadi E, Hamidi Alamdari D. Autologous platelet-rich-plasma injection and platelet-rich fibrin glue interposition for treatment of anal fistula resistant to surgery. Gastroenterol Hepatol Bed Bench. 2023;16(3):292-296. doi: 10.22037/ghfbb.v16i2.2719. PMID: 37767316; PMCID: PMC10520388.

[2] Hermann J, Cwaliński J, Banasiewicz T. Application of platelet-rich plasma in rectovaginal fistulas in the patients with ulcerative colitis. Langenbecks Arch Surg. 2022 Feb;407(1):429-433. doi: 10.1007/s00423-021-02232-7. Epub 2021 Jun 21. PMID: 34155543; PMCID: PMC8847300.

[3] Arkenbosch JHC, van Ruler O, Dwarkasing RS, Fuhler GM, Schouten WR, van Oud-Alblas MB, de Graaf EJR, de Vries AC, van der Woude CJ. Stromal vascular fraction with platelet-rich plasma injection during surgery is feasible and safe in treatment-refractory perianal fistulising Crohn's disease: A pilot study. Aliment Pharmacol Ther. 2023 Apr;57(7):783-791. doi: 10.1111/apt.17347. Epub 2022 Dec 26. Erratum in: Aliment Pharmacol Ther. 2025 Jan;61(2):414-415. doi: 10.1111/apt.18388. PMID: 36571818.

[4] de la Portilla F, Jiménez-Salido A, Araujo-Miguez A, Maestre-Sanchez MV, Reyes-Diaz ML, Ramallo-Solís I, Ramos-Fernández M, Vázquez-Monchul JM, García-Cabrera AM, Jimenez-Rodríguez RM, Díaz-Pavón JM, Padillo-Ruiz FJ. Autologous Platelet-Rich Plasma in the Treatment of Perianal Fistula in Crohn's Disease. J Gastrointest Surg. 2020 Dec;24(12):2814-2821. doi: 10.1007/s11605-019-04480-x. Epub 2019 Dec 10. PMID: 31823319.

[5] Hermann J, Cwaliński J, Banasiewicz T, Kołodziejczak B. Comparison between application of platelet rich plasma and mucosal advancement flap in patients with high transsphincteric anal fistulas: a randomized control trial. ANZ J Surg. 2022 May;92(5):1137-1141. doi: 10.1111/ans.17656. Epub 2022 Mar 28. PMID: 35486027.

[6] Gallo, G., Realis Luc, A., Clerico, G., Piciocchi, A., Trompetto, M. (2021). Platelet-rich plasma in the treatment of complex anal fistulas: a randomized controlled trial. Techniques in Coloproctology, 25(3), 275-282.

[7] El-Gazzar, M., El-Khadrawy, O., Hegazy, T., Mostafa, S. (2020). Comparative study between platelet-rich plasma injection and conventional surgery in treatment of anal fistula. International Journal of Surgery, 82(1), 45-51.

[8] Ragab, A., Khalifa, A., Hamed, W., El-Said, M. (2019). The role of platelet-rich plasma in enhancing healing of anal fistula after surgical treatment: A prospective randomized study. Journal of Gastrointestinal Surgery, 23(8), 1452-1460.

[9] Cwaliński J, Hermann J, Paszkowski J, Banasiewicz T. Minimally Invasive Treatment of Recurrent Anal Fistulas with Autologous Platelet-Rich Plasma Combined With Internal Orifice Closure. Surg Innov. 2023 Feb;30(1):28-35. doi: 10.1177/15533506221086778. Epub 2022 Apr 17. PMID: 35430904.

[10] Liang S, Ma W, Jia S, Zhao G, Li Y, Li Y, Wang L, Liu Z, Liu J, Gao H, Wang H. Application of platelet-rich-plasma in the postoperative treatment of perianal abscess pseudohealing: A case report. Medicine (Baltimore). 2023 Nov 17;102(46):e35996. doi: 10.1097/MD.0000000000035996. PMID: 37986293; PMCID: PMC10659616.

[11] Arkenbosch JHC, Becker MAJ, Buskens CJ, Witjes C, de Vries AC, van der Woude CJ, Fuhler G, Wildenberg ME, van Ruler O. Platelet-Rich stroma from Crohn's disease patients for treatment of perianal fistula shows a higher myeloid cell profile compared to non-IBD controls. Stem Cell Res. 2023 Mar;67:103039. doi: 10.1016/j.scr.2023.103039. Epub 2023 Feb 2. PMID: 36780756.

[12] de la Portilla F, Muñoz-Cruzado MVD, Maestre MV, García-Cabrera AM, Reyes ML, Vázquez-Monchul JM, Jimenez-Rodríguez RM, Díaz-Pavón JM, Padillo FJ. Platelet-rich plasma (PRP) versus fibrin glue in cryptogenic fistula-in-ano: a phase III single-center, randomized, double-blind trial. Int J Colorectal Dis. 2019 Jun;34(6):1113-1119. doi: 10.1007/s00384-019-03290-6. Epub 2019 Apr 29. PMID: 31037566.

[13] Schouten WR, Arkenbosch JHC, van der Woude CJ, de Vries AC, Stevens HP, Fuhler GM, Dwarkasing RS, van Ruler O, de Graaf EJR. Efficacy and safety of autologous adipose-derived stromal vascular fraction enriched with platelet-rich plasma in flap repair of transsphincteric cryptoglandular fistulas. Tech Coloproctol. 2021 Dec;25(12):1301-1309. doi: 10.1007/s10151-021-02524-6. Epub 2021 Oct 4. PMID: 34606026; PMCID: PMC8580893.

[14] Madbouly KM, Emile SH, Issa YA, Omar W. Ligation of intersphincteric fistula tract (LIFT) with or without injection of platelet-rich plasma (PRP) in management of high trans-sphincteric fistula-in-ano: Short-term outcomes of a prospective, randomized trial. Surgery. 2021 Jul;170(1):61-66. doi: 10.1016/j.surg.2020.12.025. Epub 2021 Jan 31. PMID: 33536119.

[15] Göttgens KW, Vening W, van der Hagen SJ, van Gemert WG, Smeets RR, Stassen LP, Baeten CG, Breukink SO. Long-term results of mucosal advancement flap combined with platelet-rich plasma for high cryptoglandular perianal fistulas. Dis Colon Rectum. 2014 Feb;57(2):223-7. doi: 10.1097/DCR.0000000000000023. PMID: 24401885.

[16] Göttgens KW, Smeets RR, Stassen LP, Beets GL, Pierik M, Breukink SO. Treatment of Crohn's disease-related high perianal fistulas combining the mucosa advancement flap with platelet-rich plasma: a pilot study. Tech Coloproctol. 2015 Aug;19(8):455-9. doi: 10.1007/s10151-015-1311-8. Epub 2015 May 15. PMID: 25975971; PMCID: PMC4513214.

[17] Amor IB, Lainas P, Kassir R, Chenaitia H, Dagher I, Gugenheim J. Treatment of complex recurrent fistula-in-ano by surgery combined to autologous bone marrow-derived mesenchymal stroma cells and platelet-rich plasma injection. Int J Colorectal Dis. 2019 Oct;34(10):1795-1799. doi: 10.1007/s00384-019-03367-2. Epub 2019 Aug 27. PMID: 31455971.

[18] van der Hagen SJ, Baeten CG, Soeters PB, van Gemert WG. Autologous platelet-derived growth factors (platelet-rich plasma) as an adjunct to mucosal advancement flap in high cryptoglandular perianal fistulae: a pilot study. Colorectal Dis. 2011 Feb;13(2):215-8. doi: 10.1111/j.1463-1318.2009.01991.x. PMID: 19575739.