

Evaluation of The Effect of Platelet Rich Plasma on the healing of the lay open surgically repaired sacrococcygeal pilonidal sinus.

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Abstract

Background: Pilonidal sinus disease indicates a disease consisting of hair-containing sinus usually found in the sacrococcygeal area. The two main surgical methods of pilonidal sinus disease include excision with primary closure/flap repair or excision of the sinus with healing by secondary intent. Wounds left open to heal by secondary intent remain extremely common due to their association with reduced risk of recurrence, however, it is associated with prolonged healing times.

Aim of the work: This study was done for evaluation of the role of PRP in accelerating wound healing of fourty patients with pilonidal sinus disease for whome lay-open excision of pilonidal sinus disease with secondary healing method was done.

Patients and Methods: This prospective randomized study was performed Between October 2020 and September 2021 on 40 patients with uncomplicated sacrococcygeal pilonidal sinus in the Department of surgery, Al-Azhar University Hospital, Damietta. The patients were randomly subdivided into two groups (1) Group A (Control group): comprised 20 patients who underwent a total excision of the pilonidal sinus adopting the lay-open technique and the wound was laid open for secondary healing. (2) Group B (PRP group): comprised 20 patients who underwent the same procedure. The platelet-rich plasma was injected into the surgical wound just after surgery and on postoperative days 3, 7 and 14.

Results: The PRP group (B) experienced accelerated healing, which was identified on week 1 (day 7) and resulted in a significant difference. Week 2 (day 14), Week 3 (day 21), Week 4 (day 28), and Week 5 (day 35) all revealed a very significant difference. At week 6 (day 42) it becomes significant again.

Conclusions: According to this study's findings, PRP therapy considerably shortens the healing time and post-operative pain associated with pilonidal wounds following surgery, also the time needed to resume work or daily activities, and complications are decreased. PRP therapy would therefore probably lessen the financial burden related to lay-open excision of pilonidal sinus illness.

Keywords: Pilonidal sinus, PRP, Lay-open excision

Abbreviations: PRP (Platelets rich plasma)

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Introduction

Pilonidal sinus disease is an old disease first identified by Hodges in 1880. It indicates a disease consisting of hair-containing sinus usually found in the sacrococcygeal area ⁽¹⁾.

The incidence of pilonidal sinus disease (PSD) is approximately 26 per 100,000 population with a male predominance of 2:1 and the mean age of those affected is from 19 to 30 years of age ⁽²⁾.

Pilonidal disease (PD) is a chronic situation which may be asymptomatic (midline pits in the natal cleft) or may cause pain, discomfort, inflammation, discharges, and inability to do daily routines ⁽³⁾.

For the treatment of this disease, surgery has been introduced and performed through three main strategies as follow: 1) surgical excision 2) healing of overlying skin 3) prevention of recurrence ⁽⁴⁾. Although all surgeons agree on these strategies, an issue will remain unsolved to whether leave the wound open or to close it after the surgery. According to the data, despite the faster healing time in primary

closure, the recurrence risk is increased up to 58% in comparison to an open wound until complete healing which is also known as secondary intention^(5,6)

In a meta-analysis, it was shown that wounds with primary closure usually heal in week 2 whilst this period of time in secondary intention method is about 2 months⁽⁴⁾.open method also requires frequent daily dressing with a risk of infection and delayed wound healing⁽⁶⁾.Platelet Rich Plasma (PRP) which contains concentrated growth factors have been reported to accelerate wound healing by 30–40% giving a satisfactory outcome in the treatment of chronic skin and soft tissue lesions by supplying large amounts of growth factors and chemokines⁽⁷⁾.

Platelet-rich plasma is a product widely used in regenerative medicine, mostly autologously, for acceleration of wound healing in different ulcer and wounds in various surgeries such as skin and soft tissue lesions⁽⁸⁾, maxillofacial⁽⁹⁾, diabetic foot ulcers⁽¹⁰⁾, and plastic surgeries⁽¹¹⁾.

Platelets in PRP contain a-granules that on their degradation, several angiogenic inducers are released including vascular endothelial growth factor, insulin like growth factor, platelet derived angiogenesis factor, transforming growth factor β , epidermal growth factor, platelet derived growth factor, Fibroblast growth factor, and connective tissue growth factor⁽¹²⁻¹⁶⁾.

Patients and methods

Between October 2020 and September 2021, 40 patients underwent surgical treatment for uncomplicated sacrococcygeal pilonidal sinus in the Surgery Department, Al-Azhar University Hospital, New Damietta. The study was approved by the Ethics Board of Al-Azhar University. The patients were randomly subdivided into two groups using a table created on computer software:

- (1) Group A (Control group): comprised 20 patients who had the pilonidal sinus completely removed using the lay-open approach, leaving the wound exposed to promote secondary healing.
- (2) Group B (PRP group): comprised 20 patients who experienced the same operation. Furthermore, an injection of platelet-rich plasma was made into the surgical wound. on day 3, 7 and 14.

Inclusion criteria for surgical treatment included patients who presented with sacrococcygeal pilonidal sinus even recurrent cases.

Exclusion criteria included patients who presented with acute pilonidal abscess, uncontrolled diabetes mellitus, anemia or thrombocytopenia (on anticoagulant treatment) and also patients who have pits below the coccyx.

Operative technique

All patients received 1 g of third-generation cephalosporin intravenously as a prophylaxis just before the operation. The procedure was carried out under spinal anesthesia. The patients were positioned prone., then prep and drape was performed. Methylene blue was injected through all sinus openings to visualize the border of the cysts and all tracts. After the presacral fascia was reached, the sinus was removed using an elliptical incision that contained the sinus orifice, and the homeostasis was completed.

After the surgery, the wound was filled using normal saline solution and then re-drained in order to find the wound volume. This step was performed in order to estimate the proper amount of PRP for injection as well as measuring wound volume for further evaluations.

Platelet rich plasma preparation

25cc of venous blood was drawn from the patient using a 30mL syringe containing 3mL anticoagulant: sodium citrate 3.8% then the blood was shaken gently 4 times. The blood was collected in seven 4 ml clean vacutainer tubes. The citrated blood was centrifuged at 1700 rpm at room temperature for 15 minutes., separating red blood cells at the bottom with plasma at the top and a “buffy coat” in between. The plasma and the buffy coat were aspirated from every test tube into a syringe and exchanged to another tube then centrifuged again at 3000 rpm for 10 min at room temperature resulting in two layers of plasma: the upper layer consists of platelet-poor plasma (PPP); and the lower layer consists of platelet-rich plasma (PRP). The PPP was carefully aspirated, to separate it from the PRP.

Postoperative care

All patients in both groups were discharged the next morning after the operation after receiving instructions for home dressing (twice a day) consisting of wound irrigation with normal saline, disinfection with 10% povidoneiodine, and using sterile, absorbent cotton gauze as a dressing. Ceftriaxone intramuscularly (IM/24 h) was given as post-operative prophylaxis. To avoid interfering with platelet function, Tab 500 mg of paracetamol is given triple daily as pain reliever instead of NSAID

PRP injection in the postoperative period

The first injection was performed right after surgery (in which PRP was injected up to 13 mm deep into the wound area (0.1 cc/cm²)). On postoperative days 3, 7 and 14, patients were scheduled for injection visits. Fresh frozen plasma was injected into the wound to a depth of 13 mm via the granulation tissue under the skin using a 0.1 cc/cm² insulin needle as soon as possible for each injection (the entire process took less than 30 seconds), and the leftover PRP was then injected into the wound. The surface was then covered with sterile non-allergenic latex to prevent PRP leakage for 24 hours. After 24 hours, the latex covering was taken off, and the usual dressing was put on.

Follow up and evaluation.

All patients were called for follow up visits every week for 6 weeks. The evaluation of the wound's capacity and the calculation of the pain score—a numerical rating system ranging from 1 to 10—were carried out at each visit. Every time a patient visited; the same surgeons evaluated them.

In order to assess post-operative healing, patients' wound volumes (the primary outcome measure) were measured. The total healing time was found to be contingent upon the volume capacity of the residual gap following sinus excision, with the cutoff point being set at a specific wound volume, the healing would be called delayed wound healing) and post-operative pain duration (secondary outcome measure) on day 3, weeks 1, 2, 3, 4, 5 and 6 postoperatively. Other measured data included the incidence of wound infection (surgical site infection), the duration of pain killer treatment and time to return to work. The wound volume was assessed by the same method used intra-operatively.

Statistical analysis:

The SPSS software package version 20.0 was used to analyze the data (Prentice-Hall, Chicago, IL, USA). The number and percentage were used to describe qualitative data. The student t-test was used to compare quantitative data. The Chi-square (X²) test was used to compare categorical variables between the 2 groups. When more than 20% of the cells had an expected count of less than 5, Chi-square correction was performed using the Fisher Exact test or Monte Carlo correlation (MC). A “p” value of less than 0.05 was considered to be statistically significant.

Results:

There was no significant difference between the 2 groups as regard to mean age of the patients or mean duration of symptoms in months. As regard to sex, all patients were males in the 2 groups (**Table 1**).

Table (1): Demographic data in the two groups.

Parameter	Group (A) Control group N=20	Group (B) PRP group N=20	P -value
Age in years (mean \pm SD)	24.62 \pm 5.33	23.42 \pm 5.77	P = 0.50 (non-significant)
Sex (all were males) Male (N (%))	20 (50%)	20(50%)	-
Duration of symptoms (months)	11.22 \pm 2.9	11.52 \pm 3.34	P= 0.76 (non – significant)

The time of comfortable sitting was significantly shorter in PRP group (11.35 \pm 1.83 in PRP group versus 17.42 \pm 2.56 in control group), The pain duration was also significantly shorter in PRP group (9.62 \pm 1.94 in PRP group versus 15.92 \pm 2.1 in control group) (**Table 2**) and (**figure 1**).

As was expected according to the previous results, the time of return to work was significantly earlier in PRP group (14.11 \pm 1.96 in PRP group versus 26.18 \pm 1.87 in control group) (**Table 2**) and (**figure 1**).

Table (2) Post operative outcome in the two groups.

Parameter	Group (A) Control group N=20	Group (B) PRP group N=20	P -value
Time of comfortable sitting (days)	17.42 \pm 2.56	11.35 \pm 1.83	P < 0.001 (HS)
Pain duration(days)	15.92 \pm 2.1	9.62 \pm 1.94	P< 0.001 (HS)
Time of return to work(days)	26.18 \pm 1.87	14.11 \pm 1.96	P < 0.001 (HS)

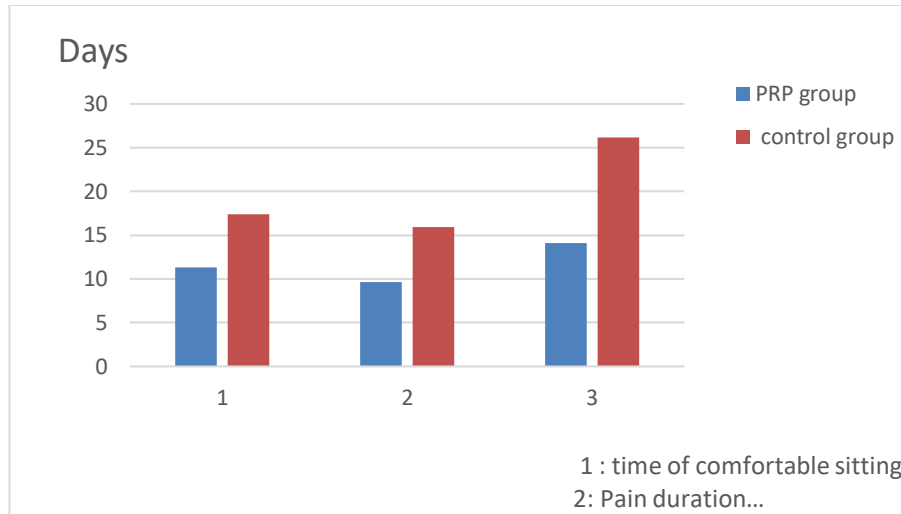


Figure (1) Post operative outcome in both PRP and control groups along the follow up period.

The rate of wound healing was estimated by wound volume (cm) starting from the operative day just after excision of the sinus with good haemostasis (day 0). Accelerated healing in the PRP group (B) was detected at week 1 (day 7) resulting in significant difference, with a highly significant difference detected at week 2 (day 14), week3 (day 21), week4 (day 28) and week 5 (day 35). At week 6 (day 42) it becomes significant again (**Table 3**) and (**figure 2**).

Table (3): Comparing wound volume in relation to postoperative time between the two groups.

Wound volume (ml)	Group (A) Control group N=20	Group (B) PRP group N=20	P-value
day 0 (Just postoperatively)	31.30±3.3	31.60± 2.80	0.76 NS
1 st week	28.60±1.80	26 .80± 1.70	0.002 (S)
2 nd week	21.80 ± 1.45	17.30± 1.6	0.001 (HS)
3 rd week	17.70 ±1.80	10.80 ± 1.30	0.001 (HS)
4 th week	12.20± 1.30	5.40± 0.70	0.001 (HS)
5 th week	6.10 ± 0.50	3.40±0.40	0.001 (HS)
6 th week	4.10 ± 1.80	2.80±0.40	0.003 (S)

HS means highly significant ($p < 0.001$), **S** means significant while **NS** means non-significant ($p > 0.05$)

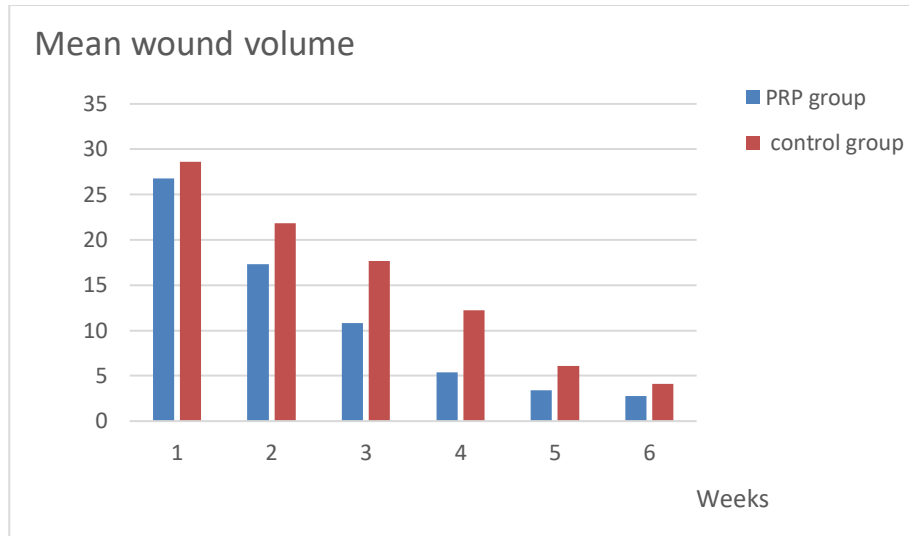


Figure (2) Mean wound volume in both PRP and control groups along the follow up period.

The mean time of complete healing was 42 ± 2.3 days in group B (PRP group), while it was 54 ± 2.2 days in group A (control group) with a p value of 0.001, with a statistically significant difference which indicates considerable effect in the treated group.

As regards postoperative complications, wound infection was found in 3 patients of control group (15%) and in 2 patients of PRP group (10%) without significant difference (**Table 4**). Delayed wound healing was found in 2 patients control group (10%) and in one patient of PRP group (5%) without significant difference (**Table 4**).

Table (4): Comparison of postoperative complications between the two groups.

Variable	Group (A) Control group N=20	Group (B) PRP group N=20	P value
Wound infection	3 (15 %)	2 (10 %)	NS
Delayed wound healing	2 (10 %)	1 (5 %)	NS

Discussion

Pilonidal sinus disease is associated with pain and discomfort which may even last after the surgery for a noticeable period of time causing the waste of working days in active young population as well as being a burden to health care system's resources ⁽⁵⁾. Platelet related products have been used in wound healing since 1985 with a satisfactory outcome so far in the treatment of chronic skin and soft tissue lesions, maxillofacial and plastic surgery wounds by providing large amounts of growth factors and chemokines. These growth factors act as a part of the cellular communication network that influences cell division, matrix synthesis and tissue differentiation ⁽¹⁷⁾.

In this study, evaluation of the role of PRP in accelerating wound healing of forty patients with pilonidal sinus disease for whom lay-open excision of pilonidal sinus disease with secondary healing method was done which has lesser recurrence rate (3.4%) than other methods in which the wound left after excision of the sinus is closed by midline closure (recurrence rate 20.6%) or by using a flap (Z-plasty, karydakia, or Rhomboid flap) for which recurrence rate is 10.3% .

Also, in the current study, the operative time is about 25 min and the surgery is a day-case surgery, that makes the procedure less costly than the other techniques (where extra time and skills are needed for flaps placement as well as the need for drains, multi-drug usage, and more hospital stay⁽¹⁸⁾).

Although of the above, lay-open excision of pilonidal sinus disease with secondary healing method usually causes more challenging complications such as pain, discomfort, inability to do daily routines and prolonged records of time back to work in comparison to the wounds with primary closure. To prevent these issues, it is specifically important to accelerate the wound healing process in patients with pilonidal sinus disease undergoing surgery⁽¹⁹⁾. PRP therapy has been introduced as possible accelerators of wound healing after excision of pilonidal sinus.

In PRB group in the present study, wound healing acceleration was noted at the end of the first week with significant difference (p-value = 0.002) but was more pronounced and notable at the end of the 2nd, 3rd, 4th and 5th weeks (p-value = 0.001) this finding was reflected on the duration of pain (9.62 ± 1.94 days), the time of comfort sitting (11.35 ± 1.83 days), the early return to work and normal daily activity (14.11 ± 1.96 days). These findings are consistent with the study of Spyridakis and his colleagues (2009) on 52 patients who underwent an open excision, divided into two groups 22 and 30 for the control and treatment group respectively⁽²⁰⁾. The starting point of significant difference between the two groups as regard wound volume was similar to our study and accelerated wound healing was also noted after the end of the first week.

Behar and his colleagues also investigated how PRP affected pain intensity as determined by a pain linear visual scale. This study found that the pain level was considerably lower in the treatment group than in the control group (1.000 ± 0.00 in PRP vs 1.973 ± 0.164 in control, $p = 0.000$)⁽²¹⁾.

In both groups, the quality of life—including physical and mental health—was quantified by Spyridakis and his colleagues. PRP patients considerably outperformed the control group in terms of score (75 points ± 4.2 , $p < 0.03$) as opposed to (62 points ± 5.6 , $p < 0.03$)⁽²⁰⁾.

In the present study the time of comfortable sitting was significantly shorter in PRP group (11.35 ± 1.83 in PRP group versus 17.42 ± 2.56 in control group), The pain duration was also significantly shorter in PRP group (9.62 ± 1.94 in PRP group versus 15.92 ± 2.1 in control group).

Regarding the postoperative complications in the current study, surgical site infection and delayed wound healing were less common in the PRP group than in the control group (one patient in the PRP group had a surgical site infection of 5%, while two patients in the control group had a delayed wound healing rate of 10%), but the difference was not statistically significant. In contrast, Baher and his colleagues (2013) found that the infection rate increased in the treated group (four patients had infections {11%}, compared to one patient in the control group {2.7%}). This result was explained by the notion that PRP, which mostly comes from blood and plasma, creates an environment that is favorable to bacterial growth.

Spyridakis and his colleagues (2009)⁽²⁰⁾ noticed the decrease in postoperative infected patients compared with the control group which was explained by the fact that platelets contain antimicrobial proteins that have bactericidal and fungicidal properties. Cases with wound infection were treated with ciprofloxacin and clindamycin until control of infection, also wound debridement was done whenever necessary to remove the necrotic tissues.

Cihangir Akyol et al, 2021⁽²²⁾ performed a prospective randomized controlled study on patients who were over 18 years old and had chronic PS disease between March 2018 and January 2019. The patients were randomly divided into three groups. Open surgery and moist dressings were applied to

patients in group A. Open surgery followed by PRP application was performed on patients in group B. Group C underwent curettage of the sinus cavity followed by application of PRP. They concluded that PRP application improves postoperative recovery in that it speeds patients' return to daily activities, reduces their pain scores and increases their quality of life.

Qaisar I Khan and his colleagues (2022) ⁽²³⁾ performed a systematic review that favours the use of PRP compared to simple wound dressings in managing pilonidal sinus disease. They concluded that the PRP therapy results in significantly reduced healing time as well as a shorter time taken to return to work or activities of daily living. Their study also reveals that the efficacy of PRP therapy would likely reduce the economic burden associated with this condition.

Conclusion

According to this study's findings, PRP therapy considerably shortens the healing time and post-operative pain associated with pilonidal wounds following surgery, also the time needed to resume work or daily activities, and complications are decreased. PRP therapy would therefore probably lessen the financial burden related to lay-open excision of pilonidal sinus illness.

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