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Comparative analysis on the effect of Z-plasty versus conventional simple excision for the treatment of sacrococcygeal pilonidal sinus: A retrospective randomised clinical study

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Abstract

Sacrococcygeal pilonidal sinus is one of common diseases in general department. However, it is characterised, for surgeons, by high post-surgical recurrence and high incidence of post-surgical wound complications. Due to that fact, this retrospective randomised clinical study was designed to evaluate the surgical procedure effect of Z-plasty (ZP), compared with convention simple excision (SE). A total of 67 patients from May 2015 to May 2019 in our department were studied into two groups randomly, the group of ZP and the group of SE. The patients' characteristics, surgical data, hospital length of stay (LOS), and post-surgery complications were recorded. Statistical approaches were proceed with *P*-value analysis. The results are as follows. No significant differences were found between these two groups of the ages, gender distribution, Body Mass Index (BMI), smoking history, diabetes mellitus, and blood hypertension. The estimated blood loss, specimen volume, distance to anus, and drain output on the first day of post-surgery between the two groups were not statistically significant, either. However, surgical time in the ZP group was longer than that in the SE group ($P < .0001$). LOS in the ZP group was obviously shorter than that in the SE group ($P = .0051$). Furthermore, the patients of the ZP group were tending to suffer from fewer post-surgical complications than the ones of the SE group. In a conclusion, we hold the point view that the surgical procedure of ZP can lead a better outcome than SE because it demonstrated shortened LOS and fewer post-surgical complications.

KEYWORDS

Sacrococcygeal pilonidal sinus, tension-free, Z-plasty

1 | INTRODUCTION

Sacrococcygeal pilonidal sinus (SPS) is a common disease in general department, prevalently observed an external opening in the sacrococcygeal region. SPS has an incidence rate of 26/10,000 persons per year,[1] with a susceptible population from 15 years old to 30 years old.[2] As frequently, there were no obvious symptoms in the sacrococcygeal region, it would have been ignored by patients and delayed to diagnose by doctors. SPS may be complaint occasionally by a neoplasm found or a formation of acute or chronic abscess.

Although it is still argued whether it is congenital generation or acquired, it is widely accepted that keratin plugs, hair remnants as foreign bodies could be found inside the sinus.[3] Considering these foreign bodies' existence, observation to SPS often starts from local infection at the sacrococcygeal site, and it would end with fistula formation if no in-time proper treatment approach is used.

To date, various surgical procedures have been described to deal with SPS; however, the best treatment strategy remains unclear.[4-8] Although there is no agreement with the ideal approach, the purposes of a surgical procedure as a common sense among surgeons are low morbidity of post-surgical recurrence, low incidence of post-surgical wound complications, and quick return back to work or education.[9] With these purposes, convention simple excision (SE) seems to have no advantage considering its rates of recurrence and complications, which may take a longer period to recover. Therefore, other surgical procedures are described by literatures in order to achieve such purposes, including Limberg flap, Karydakis flap, V-Y flap, and Z flap.[10,11]

Key Messages

- the designation of Z shape makes the wound without tension or with little surface tension possible after excision of Sacrococcygeal pilonidal sinus (SPS)
- local excision plus Z-plasty, as a treatment for SPS, provides advantages over conventional simple excision, due to the reason that Z-plasty demonstrates significantly less wound dehiscence and shorter length of stay (LOS)

In order to evaluate the effect of Z-plasty (ZP) for the treatment of SPS, a retrospective randomised clinical study was designed, with a comparison with conventional SE. All the patients chosen in this study all followed the algorithm of workup of SPS in this study. The diagram and protocol of workup followed is presented in Figure 1.

2 | METHODS

2.1 | Patients

A retrospective study was performed with data of 93 patients who had planned to receive surgical treatments for SPS from May 2015 to May 2019 at our department of general surgery, the Second Hospital of Jilin University, Changchun, China. After algorithm of workup selection, 67 patients were eventually enrolled

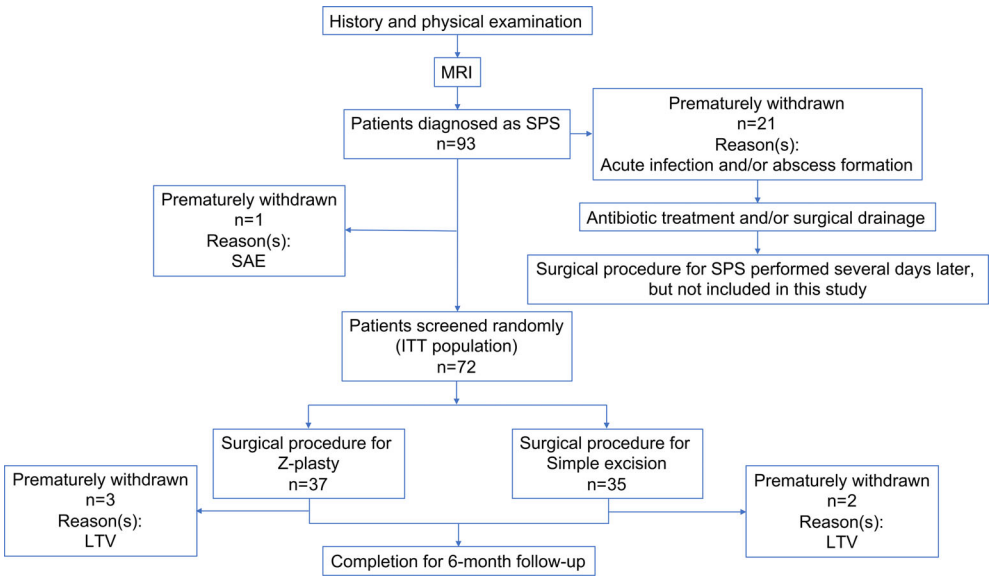

FIGURE 1 Flowchart of patients through this study. MRI, magnetic resonance imaging; ITT, intention to treat; LTV, Loss to visit; SAE, serious adverse event; SPS, Sacrococcygeal pilonidal sinus

into this study (Figure 1). Among them, 34 patients received the surgery of ZP, while other 33 patients received the surgery of conventional SE. Several data were recorded such as age, gender, Body Mass Index (BMI), smoking history, diabetes mellitus, and hypertension, which are shown in Table 1.

2.2 | Surgical procedure

The conventional simple excision group (SE group): After the combined spinal-epidural anaesthesia conducted, a conventional SE was performed on all the patients of this group. The surgical site was designed in order that the SPS was in the centre. A longitudinal spindle-shape excision was performed from the skin into the presacral fascia, with the purpose of entire resection of sinus. After haemostasis, the wound was closed with some tension inevitably. Considering the possibility of abscess formation and/or effusions, one or two tube(s) was/were placed inside the wound, of which the end was connected with the negative pressure drainage box. The number of tube(s) placed depended on liquid quantity left in and around the excision site.

The Z-plasty group (ZP group): All the surgeries were performed under combined spinal-epidural anaesthesia at the beginning. A longitudinal excision was conducted deeply enough in order to make sure the entire SPS was removed thoroughly. A ZP was designed with a 50° angle. Then, the soft tissue under the two skin flaps was released and elevated from the deep tissue, meanwhile, the veins, the arteries, and the nerves in the flaps were preserved as many as possible. After that, the two flaps were all rotated to the opposite remaining defect. One or two tube(s) was/were placed inside the wound, as same as that in SE group. Finally, the wound was sutured without any tension or with little surface tension (Figure 2).

After the surgery of the two groups, the dressing was performed without pressure. The gauzes were changed every 2 to 3 days normally if the wound was recovered without any complications.

TABLE 1 Patients' characteristics

	Z-plasty group ($n = 34$)	Simple excision group ($n = 33$)	*P*-value
Age (y, mean ± SD)	24.38 ± 6.03	23.03 ± 5.23	.3318
Gender (cases)			
Male	24	20	.4469
Female	10	13	
BMI (kg/m^2, mean ± SD)	27.40 ± 3.26	27.17 ± 3.09	.7680
Smoking history (y/cases)	2.6 ± 1.36/5	2.5 ± 0.5/4	.8940
Diabetes mellitus (cases)	8 (23.53%)	5 (15.15%)	.5387
Hypertension (cases)	2 (5.88%)	3 (9.09%)	.6728

Abbreviations: BMI, Body Mass Index.

2.3 | Surgical and post-surgical data

In order to evaluate the effect of ZP group and SE group, some data were collected during surgery and post-surgery, such as surgical time, estimated blood loss, specimen volume, distance to anus, drain output on the first post-surgical day.(Table 2) The post-surgical suture picture was shown in Figure 3, from which a Z shape

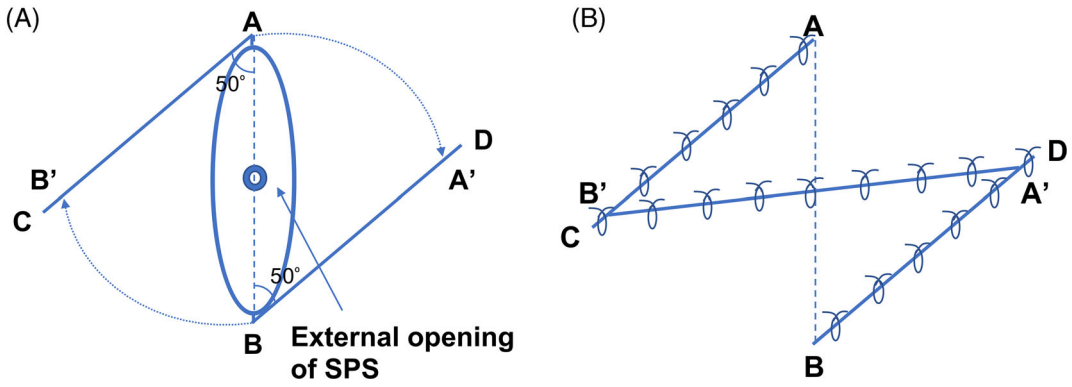

FIGURE 2 Schematic diagram of Z-plasty excision. A, A full-thickness longitudinal spindle-shape excision from SPS centred was performed firstly. Then a Z-plasty was designed. B, The two flaps were all rotated to their opposite directions, to cover the remaining defect, then sutured

TABLE 2 Surgical data and hospital length of stay (LOS) (mean ± SD)

	Z-plasty group ($n = 34$)	Simple excision group ($n = 33$)	*P*-value
Surgical time (min)	44.74 ± 4.91	30.76 ± 3.54	<.0001[a]
Estimated blood loss (ml)	10.59 ± 4.33	9.85 ± 4.84	.5116
Specimen volume (cm^3)	39.06 ± 6.77	40.79 ± 6.09	.2764
Distance to anus (cm)	3.91 ± 0.98	4.03 ± 1.09	.6370
Drain output on the first post-surgical day (ml)	18.44 ± 4.54	16.79 ± 4.81	.1526
LOS (d)	13.62 ± 2.25	16.06 ± 4.35	.0051[a]

[a]Statistically significant.

FIGURE 3 Post-surgical suture picture with a Z shape suturing and negative pressure drainage tubes

suturing and negative pressure drainage tubes could be seen. Aiming to get a further comparison of the outcomes between these two groups, post-surgical complications, including pain VAS score, surgical site infection, wound dehiscence, abscess, recurrence at different time point, are tabulated in Table 3. All patients in both groups were required to fill out a questionnaire to access the feeling of pain degree on the first day, the first week, the second week, the third week, and the fourth week according to a visual analogue scale (VAS) from 0 (no pain) to 10 (worst pain imaginable) (Figure 4). The patients also underwent a physical examination on the first month, the third month, the sixth month after surgery, to access the recurrence of SPS and the duration of recovery.

2.4 | Data analysis

Mean ± SD was used to describe the continuous values, and percentage was used to describe categorical values. The distribution of the variables was checked by the Kolmogorov-Simirnov test. Statistical analysis of continuous values between ZP group and SE group was through the independent samples *t* test. The Mann–Whitney *U* test and the χ^2 test were used for the comparison of quantitative data. Statistical analysis of categorical values between these two groups was by using Pearson Chi-square test or Fisher's exact test. Prism (Vision 8.0) was used for statistical analyses. The differences were considered to be significant statistically when the p value was <0.05.

2.5 | Ethical considerations

A written informed consent was obtained from every patient in this study, and institutional Ethics Committee of the Second Hospital of Jilin University approved this study.

3 | RESULTS

As shown in Table 1, the patients' characteristics have been presented. The ZP group consisted of 24 males and 10 females, with a median age of 24.38 years old; meanwhile, the SE group consisted of 20 males and 13 females, with a median age of 23.03 years old. There were no significant differences in age or gender distribution between these two groups. The BMI, smoking history, diabetes mellitus, and hypertension were also recorded in these two groups, without any apparent difference found.

Some important surgical and post-surgical data were presented in Table 2. The surgical time of ZP group was significantly longer than that of SE group ($P < .0001$). However, estimated blood loss did not increase comparable with a longer surgical time in ZP group. There were also no statistical differences in specimen volume or distance to anus between the two groups. It means that a ZP group had a larger surgical area, so at the first, we thought the volume of drainage would be larger, but in the fact, we found the volume was not larger than thought before. Interestingly, the volumes of drain output of these two groups were recorded with no statistical difference. Additionally, the length of stay (LOS) of ZP group was shorter than that of SE group ($P = .0051$), also out of our prediction. The reason, which was already shown in Table 3, was that the SE group had a higher incidence of wound dehiscence, and the patients had to stay in hospital to receive a further wound care treatment.

TABLE 3 Post-surgery complications

	Z-plasty group ($n = 34$)	Simple excision group ($n = 33$)	*P*-value
Pain VAS score on the first day	5.88 ± 1.13	4.82 ± 1.17	.0003[a]
Post-surgery (mean ± SD)			
Surgical site infection (cases)	2 (5.88%)	2 (6.06%)	1.0000
Wound dehiscence (cases)	1 (2.94%)	7 (21.21%)	.0272[a]
Abscess (cases)	0 (0%)	1 (3.03%)	.4925
Recurrence (cases)			
First month post-surgery	0 (0%)	0 (0%)	
Third month post-surgery	0 (0%)	0 (0%)	
Sixth month post-surgery	0 (0%)	1 (3.03%)	

Abbreviations: VAS, Visual Analogue Scale.
[a]Statistically significant.

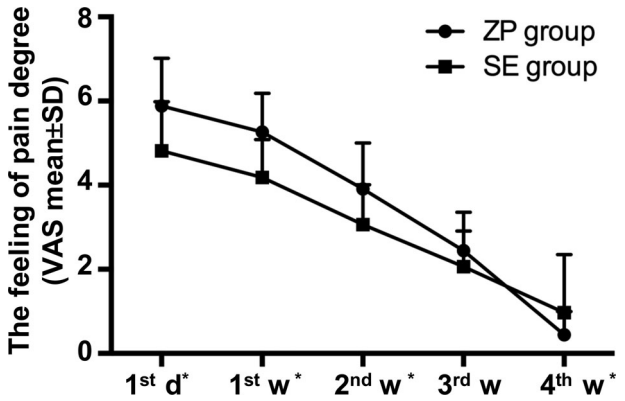

FIGURE 4 The post-surgical feeling of pain degree. Evaluated by a visual analogue scale from 0 (no pain) to 10 (worst pain imaginable). Data are presented as mean ± SD. *, statistically significant; d, day; SE group, simple excision group; VAS, Visual Analogue Scale; w, week; ZP group, Z plasty group

Although the patients in ZP group have suffered from a more complex procedure, a longer surgical time, even a higher pain VAS score on the first post-surgical day which is shown in Table 3, they have also tended to receive more benefits from suffering less post-surgery complications, such as wound dehiscence. The ZP group has a lower morbidity of wound dehiscence than the SE group ($P = .0272$); meanwhile, a higher VAS score on the first day post-surgery than SE group ($P = .0003$). However, there were no statistical differences among surgical site infection, abscess or recurrence at first month post-surgery, third month post-surgery, and sixth month post-surgery.

In order to evaluate the recovery of both surgery procedures, we further compared the feelings of pain degree of the two groups through VAS on the first day post-surgery, the first week, the second week, the third week, and the fourth week. The data are presented as mean ± SD. Considering the severity of pain, all the patients in both groups did not receive any pain reliever involvements after the surgery. The outcomes of ZP group were 5.88 ± 1.13, 5.26 ± 0.92, 3.91 ± 1.09, 2.44 ± 0.91 and 0.44 ± 0.55. Those of SE group were 4.82 ± 1.17, 4.19 ± 0.90, 3.06 ± 0.95, 2.06 ± 0.85, and 0.97 ± 1.38. The descending trend of ZP group was rapid by time. These two curves of ZP group and SE group crossed at around third week post-surgery. Furthermore, there was no statistical difference of VAS at the time point of third week post-surgery ($P = .0825$). Due to the reasons of wound dehiscence and surgical site infection, the descending trend of SE group slowed down after the third week post-surgery. On the fourth week post-surgery, the patients in the SE group tended to have a complaint of more severe painful feeling than the patients in the ZP group by the means of VAS ($P = .0427$), which were the opposite outcome comparing with the situation on the first day post-surgery ($P = .0003$).

4 | DISCUSSION

A surgical procedure, so far, has still been the most effective approach for the treatment of SPS, regardless of whether there is an acute abscess or not. However, for surgeons, a time-point chosen of surgical involvement and a proper surgical method selected should be considered carefully.

Although a surgical approach can receive a remarkable outcome for SPS, non-surgery treatment still needs a consideration for every patient before a surgical involvement decision made. Only several asymptomatic SPSs and several small sinuses without infection may be the indications for the non-surgery approach.[12]

For the patients with acute abscess formation, first episode of excision and drainage is advocated, for pursuing a lower disease recurrence rate.[13] Considering the similar recurrence rates but a longer average time period to return to work than a SE, wide en-bloc excision is not suggested

for an SPS with an acute abscess. Furthermore, Webb P. M. and Wysocki A. P., who had reviewed 243 patients who underwent excision and drainage for acute pilonidal abscess, held the view that an off-midline longitudinal drainage excision would lead to a shorter time period for wound healing than a midline longitudinal drainage.[14]

For the patients who are with asymptomatic pits or with chronic disease but not acute abscess formation, several surgical procedures are debated. Among all the surgical approaches, a common sense comes to an agreement that an entire excision of sinus and thorough removal of the hair and/or other remnants such as keratin plugs are strongly recommended. Wide en-bloc excision with primary midline closure can meet the requirement, but bring with an adventure of wound dehiscence. Then, off-midline closure suture and flaps suture with/without rotation are described by some authors.[10,15-18] With such surgical approaches, surgeons should have to make a balance among an entire excision, a quick recovery, and a low morbidity of recurrence. In this study, we have practiced the procedure of ZP with the following advantages: (a) a ZP allows surgeons to remove enough tissue suspected, in order to pursue a lower incidence of recurrence post-surgery; (b) even suffering a larger tissue resection than SE, keeping a tension-free or little surface tension surrounding the wound becomes possible, with the purpose of avoiding dehiscence; (c) the surgical site flexibility of the design of ZP can give surgeons a chance to make a decision whether undergo a midline excision or an off-midline excision, although we have chosen a midline route in this study.

A ZP with a large skin rotated area can make a choice of excision site possible, as long as the rotated skin flap can receive a successful suture with the other one. However, free-tension suture around the incision should be paid full attention by every surgeon. Off-midline incision would have a lower or free tension during patients' activities, as a result, some surgeons tend to have a chosen of off-midline incision.[19] In this study, we have a midline incision to all the patients without any severe complication, so we hold the view that a suitable flap design and a proper suture technique can come to a same outcome between midline and off-midline excision.

As shown in Table 2, the surgical time of ZP group was longer than that of SE group. The reason of this outcome was the protocol of ZP was more complicated, and more suture practice was required during the surgery. However, even with longer surgical time and larger surgical area involved, the volumes of drain output on the first post-surgical day between these two groups were almost similar, which was out of our anticipation.($P = .1526$) The LOS of ZP group was shorter than that of SE group, which meant the patients who underwent ZP would come back to work/study in a relative shorter period. More patients in SE group has suffered complications of abscess and/or wound dehiscence, which might give an explanation of longer LOS. The shorter LOS, which may reduce the duration of incapacity for work/study, and the lower incidence of wound dehiscence, which was the most concerned outcome by the patients and surgeons, may ignore the disadvantages about surgical time and pain VAS score. In both of our study groups, every patient had one or two negative press drainage box(es) inside the wound site. Because of the negative press existence, any liquid left under the wound would be drained out quickly. This would be helpful for the wound healing.

The main purpose of treatment of SPS is to remove a large enough tissue around the sinus, which is the key point related to post-surgical recurrence, meanwhile, to provide a low complication rate, which can avoid a prolonged LOS. Considering above such purposes, our group regard a successful surgical procedure should include the following details: a. thoroughly excision of SPS and its tract; b. maximal protection towards the blood supply to each plasty; c. tension-free or little surface tension upon the wound; d. strict asepsis technique during surgery. The surgical procedure of ZP can fulfil all the requirements mentioned above, so this procedure could be one of the most effective and safe approaches towards SPS.

A wound infection rate, as reported in articles, is around 1.5% to 6%.[20,21] In our present study, the wound infection rate in ZP group was 5.88%, and that rate in SE group was 6.06%. Due to the limitation of cases of patients, the infection rate maybe a little higher than other reports. An average 10% rate of wound dehiscence was supposed by some articles, however, in our ZP group, that rate was only 2.94%.[22] In this study, we did not investigate the duration of incapacity for work/study as many other reports. The reason of that is, as our group holds this point of view, the duration of out of work or study can be determined by many individual and/or non-individual factors, which could not evaluate the healing speed precisely. However, LOS may indicate the length of SPS healing somehow.

A long enough follow-up investigation can accurately show the morbidity of recurrence, usually 3 years recommended.[23,24] Due to the time limitation, our follow-up was only 6 months. However, the outcomes of the two groups still indicated the trend of a lower incidence of recurrence in ZP group.

5 | CONCLUSION

In conclusion, our study suggests that the treatment of ZP provides advantages over conventional SE, due to the reason that ZP demonstrates significantly less wound dehiscence and shorter LOS. Considering the limitations

of cases, quantity and follow-up period, some further studies may be necessary to evaluate the ZP advantage among other surgical procedures, and to analyse the recurrent rates in a long follow-up time period.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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