A novel transperineal approach for surgical resection of presacral tumors with an arc-shaped incision in front of the apex of the coccyx (with video)

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Introduction

Presacral cystic tumors are rare and are composed of many types of tumors located in the presacral space [1]. The mainstay of treatment is total excision without preoperative biopsy [2]. In recent years, the number of patients with presacral cystic tumors who have been treated in the Affiliated Cancer Hospital of Zhengzhou University has increased. In particular, >25% of patients have presented with residual presacral cystic walls with perineal refractory sinuses due to the failure of presacral tumor operations in other hospitals. We studied the surgical records of patients with failed primary procedures and suggested that inadequate surgical exposure due to a lack of proper surgical approach was the main reason. Therefore, we designed a novel surgical approach for presacral cystic tumor resection, namely transperineal tumor resection with an arc-shaped incision anterior to the apex of the coccyx. Here, we present the details and outcomes of this novel surgical approach.

Surgical approach

One hundred and sixty-one patients presented with presacral cystic tumors and underwent surgical tumor resection through the novel surgical approach in the Affiliated Cancer Hospital of Zhengzhou University (Zhengzhou, China) between January 2014 and January 2021. This surgical approach was approved by the ethics committee of the Affiliated Cancer Hospital of Zhengzhou University (2020012).

The patient was placed in the modified lithotomy position. An arc-shaped transperineal incision was made at the upper edge of the coccyx and the inner edge of the bilateral ischial tuberosities (Figure 1A). The gluteus maximus on both sides, as well as the anococcygeal ligament and coccyx, were exposed by incising the skin and the superficial and deep fascia. The anococcygeal ligament and coccyx were then cut at sites that ensured no injury to the external anal sphincter (Figure 1B). The levator ani muscle and the inferior levator ani spaces behind the rectum were completely exposed, creating sufficient space for the complete removal of the tumor located in the inferior levator ani space. Parts of the levator ani muscles (mainly the pubococcygeus) attached to the sacrococcyx were excised to gain access to the superior levator ani spaces for the tumor located in those spaces (Figure 1C and D). More operative details are shown in Supplementary Figure 1 and Video.

Data were collected from the electronic medical record system, including demographic and perioperative data, and follow-up (3 months to 5 years) data of the enrolled patients.

Surgical outcome

Patient characteristics are shown in Supplementary Table 1. The age of the patients ranged from 16 to 85 years. Forty-eight patients with perineal refractory sinuses caused by residual...
presacral walls (29.8%) had undergone one or more failed surgeries for presacral cyst resection in other hospitals. The diameter of the tumors ranged from 4 to 26 cm. The proximal level of the tumors was above S2 in only 11 patients (6.8%), whereas in most patients (93.2%), the level was no higher than S2. The pathology of the tumors consisted of 40 epidermoid cysts (24.8%), 30 dermoid cysts (18.6%), 8 tailgut cysts (5%), and 83 teratomas (51.6%).

The surgical details and complications are shown in Table 1. The median volume of intraoperative bleeding was 260 mL (range, 100–1,000 mL). The median operation time was 120 min (range, 60–210 min). All tumors had been completely resected. One patient (0.6%) underwent reoperation for presacral hemorrhage. There was no mortality and no serious complications after surgery. During the follow-up, no tumor recurrence or symptoms were observed in any patient.

**Discussion**

To our knowledge, the present study reports the largest series to date of patients at a single institution undergoing surgical resection of benign presacral cystic tumors using the novel transperineal tumor-resection approach.

The choice of surgical approach to excision depends on the location and size of the tumor. The abdominal approach has been recommended for tumors above the level of S3 [3–5]. However, distal cystic tumors (attached to the coccyx) are difficult to access using only a transabdominal approach. Therefore, the posterior approach is ideal for retrorectal tumors that do not extend above the level of S3, represented by the Kraske

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**Table 1. Surgical details and outcomes in 161 patients with presacral cystic tumors**

| Characteristic                        | Value               |
|---------------------------------------|---------------------|
| Surgical approach, n (%)              |                     |
| Transperineal approach                | 149 (92.5)          |
| Abdominoperineal approach             | 12 (7.5)            |
| Operation time, median (range), min   | 120 (60–210)        |
| Intraoperative bleeding, median (range), mL. | 260 (100–1,000)    |
| Blood transfusion, n (%)              | 18 (11.2)           |
| Complete tumor resection, n (%)       | 161 (100)           |
| Complication, n (%)                   |                     |
| Wound infection                       | 12 (7.5)            |
| Presacral hemorrhage                  | 1 (0.6)             |
| No                                    | 148 (91.9)          |
| Wound healing time, median (range), days | 14 (7–28)        |
| Post-operative hospital stays, median (range), days | 15 (8–21) |

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Figure 1. Anatomy of the surgical approach. (A) Location of the arc-shaped transperineal incision anterior to the apex of the coccyx. (B) Anatomy of the surgical approach, viewed from below. (C) Anatomy of the surgical approach, viewed from above. (D) Anatomy of the surgical approach, lateral view. (The red dotted line in each figure indicates the surgical approach.)
approach, and there are three types of surgical incisions for the approach, including longitudinal, curvilinear or transverse incisions [6]. Nevertheless, the muscles on both sides of the longitudinal incision of the posterior approaches are difficult to pull apart, which may seriously affect the visual field and operating space. Meanwhile, the posterior approach with a transverse incision, e.g. the intersphincteric approach with an inverted “V”-shaped incision or modified incision, is only suitable for resection of very low tumors [7].

The novel surgical approach can overcome these shortcomings and result in complete removal of tumors of different sizes (4–26 cm in diameter) even if they are at a proximal level above S2; therefore, we suggest that this surgical approach is safe for most surgeons to resect cystic tumors with a proximal level not higher than S3. Another advantage of our surgical approach is anorectal-ring protection. An arc-shaped transperineal incision is performed, and the tumor and the anus are pulled in opposite directions, creating a gap that enables the separation of the adhesion between the tumor capsule and the anorectal ring.

In our experience, we found that there is a potential space between the cyst tumor and the presacral vessels and nerves. The operating space provided by the present surgical approach provides good direct visualization for the separation of adhesion between the tumor and the presacral vessels and nerves. If the tumor is large or high, appropriate volume reduction of the cyst can increase the operating space and the visual field for the separation of adhesion between the tumor and the presacral vessels and nerves.

Massive presacral hemorrhage caused by presacral vascular injury is a serious and potentially life-threatening complication of rectal and presacral surgery [8, 9]. Our surgical approach demonstrated significant advantages with regard to hemostasis. After the tumor was resected, the semi-closed cavity anterior to the sacrum could readily be packed with gauze, which was later removed, and the incision was closed approximately 1 week later under local anesthesia.

The main limitation is that this research is involved only a single-center and single-arm study. A multicenter, large-sample randomized-controlled clinical study needs to be carried out to provide more reliable evidence-based medical evidence for the surgical approach.

In conclusion, this study indicates that the surgical approach that we have developed may greatly facilitate the safe resection of presacral cystic tumors.

Supplementary Data
Supplementary data is available at Gastroenterology Report online.

Authors’ Contributions
G.C.W. and G.Q.Z. were responsible for surgical design, data analysis, and drafting and revision of the manuscript. G.C.W., G.Q.Z., Y.J.L., and Y.C.W. were responsible for operation implementation. Z.Z. and L.L.D. collected the data. All authors read and approved the final manuscript.

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None.

Conflict of Interest
The authors declare that there is no conflict of interests in this study.

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