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# **The Efficacy of Coccygectomy on Persistent Coccydynia: A Retrospective Cohort Study of 134 Consecutive Patients With a Minimum of 1-Year Follow-up**

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## **Authors' contributions:**

SM, MMJ and GØA drafted the paper, performed the study selection and analyzed and interpreted the results. AS generated the data on the patients and is the lead surgeon and supervisor on the development of this paper. LC supervised and contributed to the statistical analysis. AS, LC, MØA and MMR have done substantial revision and contributed

to the overall development of this paper. All authors read and approved the final manuscript.

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## **Abstract**

**Aims:** The aim of this study was to investigate the efficacy of coccygectomy in patients with persistent coccydynia and coccygeal instability.

**Methods:** The Danish National Spine Registry, DaneSpine, was used to identify 134 consecutive patients who underwent surgery, performed by a single surgeon between 2011 and 2019. Routine demographic data, surgical variables, and patient-reported outcomes, including a visual analogue scale (VAS) (0 to 100) for pain, Oswestry Disability Index (ODI), EuroQol five-dimension questionnaire (EQ-5D), and the Physical Component Score (PCS) and Mental Component Score (MCS) of the 36-Item Short-Form Health Survey questionnaire (SF-36) were collected at baseline and one-year postoperatively.

**Results:** A total of 112 (84%) patients with a minimum follow-up of one year had data available for analysis. Their mean age was 41.9 years, and 15 (13%) were males. At 12 months postoperatively, there were statistically significant improvements ( $p < 0.001$ ) from baseline for the mean VAS for pain (70.99 to 35.34), EQ-5D (0.52 to 0.75), ODI (31.84 to 18.00), and SF-36 PCS (38.17 to 44.74). A total of 78 patients (70%) were satisfied with the outcome of treatment.

**Conclusion:** Patients with persistent coccydynia and coccygeal instability resistant to nonoperative treatment may benefit from coccygectomy.

## Introduction

Pain located in the coccyx and surrounding tissue is referred to as coccydynia.(1) It may be secondary to trauma, obesity, childbirth, and local bony abnormality (coccygeal spicules).(2-4) Coccydynia can also arise from extracoccygeal conditions, such as pilonidal cysts, haemorrhoids, diseases of the pelvic organs, and musculoskeletal disorders affecting the surrounding structures.(5, 6) It is very painful, primarily when rising from a sitting position,(7) and can cause difficulty with defaecation(8) and sexual intercourse.(9) Thus, the condition adversely impacts quality of life of affected patients. There is no accurate information about the incidence or prevalence of the condition, and the extent of the condition in the general population is thus unknown.(9)

Various forms of treatment have been described including noninvasive therapies such as physiotherapy or non-steroidal anti-inflammatory drugs (NSAIDs) and the use of a soft cushion when sitting, interventional therapy such as ganglion blocks with steroids or electrical stimulation, and surgery.(10) The efficacy of these treatments has to some extent been reported in the literature. The symptoms resolve spontaneously in most patients after a few weeks or months of noninvasive treatment.(9) Those with persistent symptoms are typically offered interventional treatment, which is effective in many cases.(7, 11-13) Coccygectomy, partial or total, can be offered to patients who do not respond to noninvasive or interventional therapy, and for those with an unstable coccyx due to disc rupture(14).

Several authors have reported reduced pain and improved quality of life after coccygectomy in patients with coccydynia refractory to other forms of treatment.(7, 14-21) The surgery may be complicated by infection.(22) Currently, much of the available

literature consists of small retrospective series, reporting the success of treatment using non-standardized categorical outcomes, such as "improved/not improved", "no relief/some relief/complete relief", or "successful/unsuccessful".(17, 18, 23-25)

The aim of this study was to further evaluate the effect of coccygectomy as a form of treatment for coccydynia, with patient-reported outcome measures (PROMs) using validated scoring systems, from a prospective consecutive cohort of patients treated with coccygectomy.

## **Methods**

All patients were examined by the same investigator (AS) who performed a bimanual palpation of the coccyx, in order to reproduce the patients' symptoms and ensure hypermobility of the coccygeal bone. This examination was performed in the outpatient department, with the patient lying in the lateral decubitus position with flexed hips and knees. The patients were awake during the examination to confirm that the symptoms present in the sitting position were reproduced. Fluoroscopy was not used during this initial diagnostic procedure due to the concern of radiation to both patient and examiner. If the patients reported that the symptoms were reproduced with bimanual palpation, they were offered CT guided steroid injections with 1 ml of lidocaine and 1 ml of methylprednisolone acetate 40 mg/ml. All blocks were performed by a senior radiologist, after obtaining informed consent, including the added radiation exposure. The scan was performed to confirm the presence of instability and to ensure appropriate placement of the needle.

The treatment was repeated with an interval of ten to 12 weeks depending on the symptoms. Three blocks were recommended in order to evaluate its efficacy. If the patients experienced complete relief of symptoms after the second block, the third block was not performed. Instability of the coccyx was defined as the presence of anterior or posterior translation of the sacrococcygeal joint, or of one of the coccygeal segments. The diagnosis of instability was also made radiologically, when the coccygeal segments are seen on the standing radiograph and translation is seen on the CT guided steroid block, with the patient in the prone position. If the patients experienced temporary relief during the steroid injections and had recurrent symptoms during the 12 months after the third steroid block, surgery was recommended. The 12-month period was chosen to avoid more than three steroid injections per year. Patients were offered additional steroid injections if they had recurrent symptoms beyond the 12-month period. However, these patients were not included in this study. All patients in this series had temporary relief of pain for < 12 weeks after the steroid injections and further recurrent symptoms thereafter. Patients were treated with either a partial or a total coccygectomy, according to the level of the mobile segment, at the Spine Center of Southern Denmark between 2011 and 2019 (Figure 1).

Patients with previous surgery in the area, including those undergoing a further operation due to infection, fracture, or had undergone a previous coccygectomy, or with soft tissue complications and those with pilonidal cysts were excluded. Patients with congenital or malignant disorders of the coccyx were also excluded.

Of 134 patients who had surgery, complete baseline data were available for 112 (84%) with a minimum follow-up of one year. Their mean age was 41.9 years (15 to 78). There

were 97 females (87%) and 15 males (13%) (Table I). All patients were referred to our institution with a history of symptoms for between six and 18 months, and a visual analogue scale (VAS ) score when sitting of > 40. The 22 patients who were lost to follow-up were younger on average, but not significantly so ( $p = 0.063$ ). A significantly larger proportion of the 22 patients who were lost to follow-up were smokers ( $p = 0.014$ ), and had lower Euro-Qol five-dimension questionnaire (EQ-5D) scores ( $p = 0.028$ ) compared with the 112 patients included in the analysis.

All coccygectomies were performed under general anaesthesia with the patients in the prone position by the same surgeon (AS). The surrounding skin of the buttocks is retracted using wide surgical tape, allowing the surgeon to use a small incision, of 4 cm in length, exposing the soft tissue around the coccygeal bone. A longitudinal incision is made in line with the mobile segment, in order to lift the segment out of its soft tissue sac, preserving the coccygeal nerve. The unstable segment is released from the proximal disc with gentle handling of the soft tissue and the coccyx is carefully dissected free from the periosteum, and removed. The soft tissue is firmly closed in three layers using resorbable sutures, without applying tension to the pelvic floor, and the wound is dressed. No dead space remains in the soft tissues after the surgery due to the small size of the coccyx.

Laxatives are recommended postoperatively for a period of four weeks. The wound is reviewed two or three times weekly during the first two weeks, and a standardized postoperative regime for sitting is used. Antibiotic prophylaxis is given every eight hours for the first 24 hours postoperatively.



Patients treated before 1 August 2017 received 2 gm of intravenous dicloxacillin preoperatively and 1 gm three times in the first postoperative 24 hours. Patients treated thereafter received 1.5 gm of cefuroxime preoperatively and 1.5 gm three times during the first postoperative 24 hours.

Baseline characteristics, including age, sex, smoking status, body mass index (BMI), duration of symptoms, and PROMs, were collected from the DaneSpine database.(26) Data were collected prospectively using a questionnaire, modified for coccydynia, preoperatively and at one and two years postoperatively. The PROMs included VAS for pain (0 to 100),(27) Oswestry Disability Index(28) (ODI), EQ-5D,(29) 36-Item Short-Form Health Survey questionnaire (SF-36),(30) and self-reported satisfaction with treatment. The satisfaction was divided into three categories: "satisfied", "dissatisfied", and "undecided".

### *Statistical analysis*

Paired t-tests were used to compare data at baseline and follow-up. Categorical data, such as sex and smoking status, are presented as amounts and percentages, and continuous data are presented as means with SDs and ranges, if appropriate.

VAS scores in both sitting and standing position were available; however, only the highest VAS score from each patient was included in the analysis due to a reported variation in the symptoms, as patients tend to experience most pain either when sitting, or when mobilizing from sitting to the standing position. In order to base the analysis on the largest available number of patients who had follow-up of > one year, data from patients with one and two years follow-up were combined.

All analyses were performed using IBM SPSS Statistics for Windows, version 27.0. (IBM, Armonk, New York, USA). The threshold for significance was set at  $p < 0.05$ . No approval from the National Committee on Health Research Ethics was needed, as the study was a retrospective analysis of prospectively collected data, in which the patients gave consent to research when completing the questionnaires. Data approval was obtained from the Danish Data Protection Agency.

## **Results**

There were improvements in the mean VAS for pain, the ODI, the EQ-5D, and the physical and mental components of the SF-36 one year postoperatively (Table II). A total of 78 patients (70%) were satisfied, 14 (13%) were not satisfied and 20 (18%) were undecided about the outcome of treatment.

Follow-up data about infection were available for 108 patients (96%), of whom 24 (22%) developed an early postoperative infection. Two of these had a deep infection and 22 had a superficial infection, which were treated with antibiotics. At three months postoperatively, seven of 103 patients (7%) reported altered skin sensation around the incision, and two (2%) reported that altered skin sensation in the coccygeal area from before surgery had improved. A total of seven patients (6%) required revision surgery; six for infection, and one for a small bony recurrence at the tip of the coccyx one year postoperatively. One patient (1%) had a severe recurrent infection requiring several further procedures. There were no intraoperative complications and no other late infections, and no patient suffered rectal damage, reported severe constipation, or pain

during intercourse postoperatively. The site of the skin incision did not change during the study period, and no plastic surgeon was consulted.

## **Discussion**

We investigated the outcome of coccygectomy in a cohort of patients with persistent coccydynia and instability of the coccyx, refractory to both manipulation and two or three steroid injections. This is the largest prospective cohort of patients used to investigate the efficacy of coccygectomy, and shows significant improvements in self-reported pain, mobility and quality of life one year postoperatively. Overall, 70% of patients were satisfied with the outcome.

The results of the current study are comparable to previous studies on coccygectomy.(14-16, 31, 32) Hanley et al(16) found a significant decrease in both VAS ( $p < 0.0001$ ), ODI ( $p < 0.0001$ ), and SF-36 ( $p < 0.05$ ) in a cohort of 98 patients, and 70% had a successful outcome. Failed nonoperative treatment was defined as failed conservative treatment, including NSAIDs or at least one sacrococcygeal injection. Doursounian et al(14) reported excellent or good outcomes in 87% of 61 patients with coccydynia related to coccygeal instability who underwent coccygectomy, in a retrospective study. Failed nonoperative treatment was defined as failed conservative treatment with intradiscal injections and/or manipulation. A study by El Mohsen Arafa et al(31) showed a significant decrease ( $p < 0.0001$ ) in VAS scores four years postoperatively in a series of 38 patients treated with coccygectomy.

Early postoperative infection and the risk of skin breakdown are the main complications after surgery. We found an infection rate of 22% in our study. The rate remained

unchanged despite a change in strategy for antibiotic treatment. The high rate of infection was addressed by reviewing the wound two or three times weekly during the first two weeks and the use of a standardized postoperative regime for sitting, postoperatively. Earlier authors reported complication rates ranging from 0% to 28%.(14, 16, 31, 33) Doursounian et al(34) reported no postoperative infections in 80 patients after reinforcing the perioperative care with a rectal enema and inclusion of a second antibiotic. A small study by Kulkarni et al(35) reported no complications when using the Z plasty surgical technique, and Bilgic et al(36) reported a lower rate of wound infections in patients when the periosteum was not resected in the operation. These are all potential measures to consider when addressing the risk of postoperative infection. Although the current study reports on one-year follow-up data, Hanley et al(16) and Maigne et al(37) both reported little or no difference in PROMs between one and two years postoperatively. Furthermore, Maigne et al(37) reported that definitive results were achieved at four to eight months after surgery. Other authors have also reported that most improvement is seen between six months and one year postoperatively.(31, 38). Thus, they believe that a follow-up of one year after coccygectomy is enough to assess the efficacy of the procedure.

There are limitations to the study. All the operations were performed at the Spine Centre of Southern Denmark by the same surgeon, which limits the generalizability of the results. The ODI was specifically designed to assess disability in activities of daily living in patients with lower spinal conditions. Hence, it is not validated for coccydynia, but is currently the most appropriate measure of disability for these patients.

Although the study was retrospective, the patients were reviewed prospectively with baseline information collected using a questionnaire. The relatively large sample size and follow-up of > 83% also reduces the risk of bias. A non-response analysis was conducted on the DaneSpine database in 2016 by Højmark et al.(39) showing that non responders tended to report a similar or slightly better outcome than responders.

Including patients lost to follow-up could thus potentially underestimate the effect of coccygectomy as the treatment for coccydynia. The lack of a control group also is a limitation of this study, and future research should include a control group to compare the effects of coccygectomy with nonoperative treatment.

In conclusion, we found that the outcome one year after coccygectomy in patients with persistent coccydynia and coccygeal instability after nonoperative treatment was satisfactory in most patients. Complications, most commonly infection and wound dehiscence, were relatively frequent. Thus, surgery should be reserved for patients with a history of pain of more than six months and without relief from conservative treatment.

### **Abbreviations:**

VAS: Visual Analogue Scale, ODI: Oswestry Disability Index, EQ-5D: European Quality of Life – 5 Dimensions Questionnaire, SF-36v1: Short Form-36 version 1, PCS: Physical Component Score, MCS: Mental Component Score, NSAID: Non-steroidal anti-inflammatory drugs, CT scan: Computed tomography scan, BMI: Body Mass Index

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## Tables

Table I: Demographics of 112 patients who underwent coccygectomy with a follow-up of > one year.

Table I	
Variable	Patients (n = 112)
Mean age, years (SD; range)	41.9 (SD 11.4; 15-78)
Male, n (%)	15 (13%)
Smokers, n (%)	22 (20%)
BMI, kg/m <sup>2</sup> , Mean (SD; range)	26.7 (SD 5.0; 16.2-39.3)

Abbreviations: BMI, Body Mass Index

Table II: Patient-reported outcome at baseline and a minimum one year postoperatively (n = 112).

Table II				
Variable	Baseline	One-year follow-up	Difference from baseline	p-value*
Mean VAS (0-100) (SD)	70.99 (20.07)	35.34 (32.69)	35.65	<0.001
Mean ODI (SD)	31.84 (12.65)	18.00 (17.64)	13.84	<0.001
Mean EQ-5D (SD)	0.52 (0.29)	0.75 (0.29)	0.23	<0.001
Mean SF36 PCS (SD)	38.17 (9.03)	44.74 (10.87)	6.57	<0.001
Mean SF36 MCS (SD)	46.06 (11.16)	48.22 (11.39)	2.16	0.073

\*Paired t-test



Abbreviations: EQ-5D, EuroQol five-dimension questionnaire; MCS, Mental Component Score; ODI, Oswestry Disability Index; PCS, Physical Component Score; SF-36, Short-Form Health Survey questionnaire; VAS, Visual Analogue Scale.

## Figures

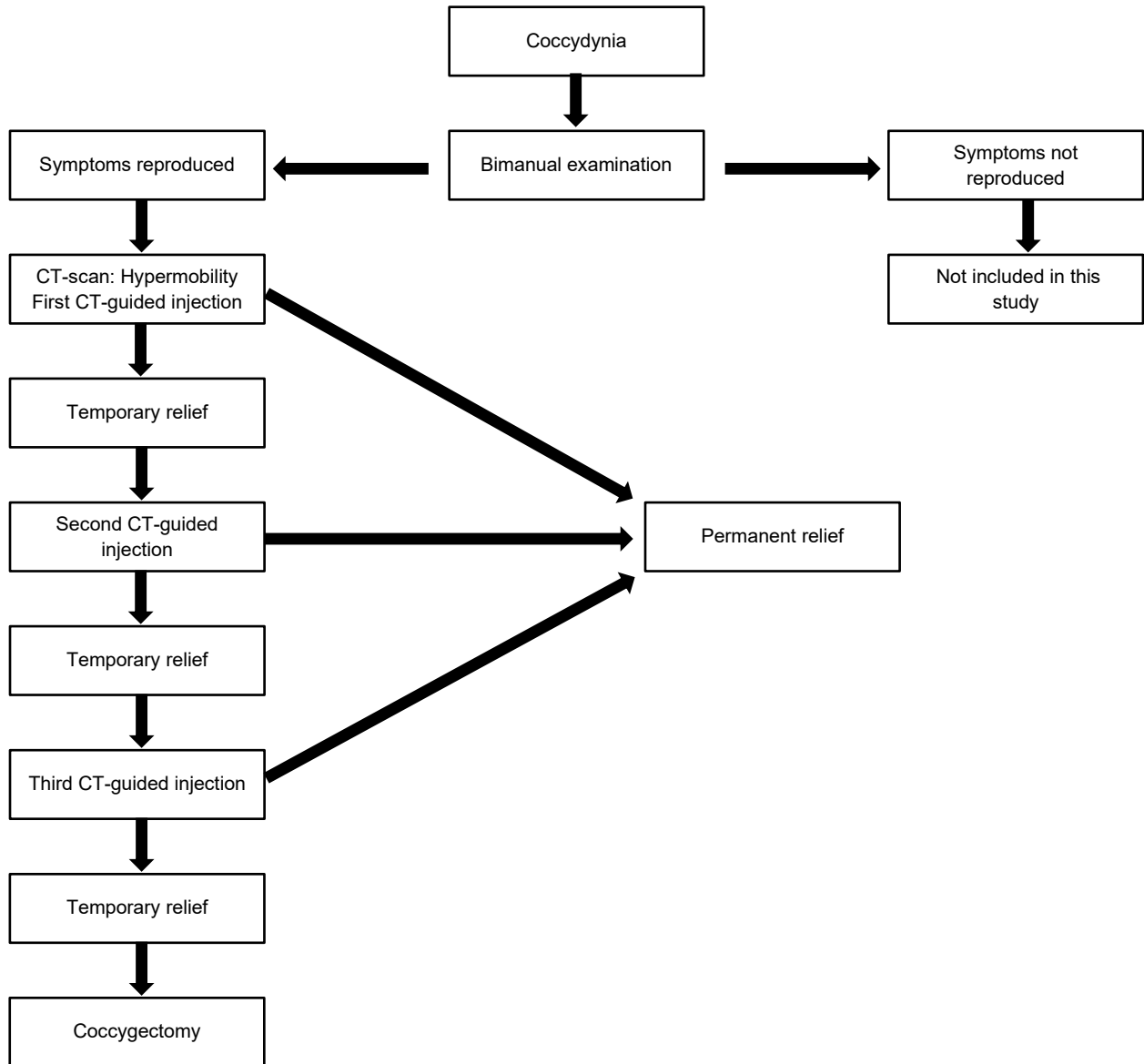


Figure 1: Treatment pathway of the patients. Surgery was recommended to those with hypermobility or instability of the coccyx, and up to three CT-guided steroid blocks with temporary relief and recurrent symptoms.