■ SPINE

Coccygectomy for patients with chronic coccydynia

A PROSPECTIVE, OBSERVATIONAL STUDY OF 98 PATIENTS

E. N. Hanley,
G. Ode,
B. J. Jackson III,
R. Seymour

From Carolinas Medical Center, Charlotte, United States

Aims

The purpose of this prospective study was to evaluate the outcomes of coccygectomy for patients with chronic coccydynia.

Patients and Methods

Between 2007 and 2011, 98 patients underwent coccygectomy for chronic coccydynia. The patients were aged > 18 years, had coccygeal pain, local tenderness and a radiological abnormality, and had failed conservative management. Outcome measures were the Short Form 36 (SF-36), the Oswestry Disability Index (ODI) and a visual analogue scale (VAS) for pain. Secondary analysis compared the pre-operative features and the outcomes of patients with successful and failed treatment, two years post-operatively. The threshold for success was based on a minimum clinically important difference (MCID) on the ODI of 20 points. All other patients, including those lost to follow-up, were classified as failures.

Results

There was significant improvement in all ten components of the SF-36 ($p < 0.05$), the ODI (23 points) and VAS (39 points) ($p < 0.0001$). A total of 69 patients (70.4%) met the designated MCID threshold for a successful outcome. The failure group consisted of 25 patients (25.5%) who did not reach the MCID and four (4.1%) who were lost to follow-up. Six patients (6.1%) in the failure group had ODI scores that were no better or worse than that pre-operatively. The patients in whom treatment failed had significantly worse pre-operative scores for the ODI ($p = 0.04$), VAS ($p = 0.02$) and on five of ten SF-36 components ($p < 0.04$). They also had a higher incidence of psychiatric disorders, pre-operative opiate use and more than three comorbidities.

Take home message: Coccygectomy for chronic coccydynia results in significant improvement in patient-reported outcomes at two years. Failure is associated with certain pre-operative characteristics such as psychiatric illness, poor quality of life features, higher levels of pain, and use of opiates.

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■ E. N. Hanley, MD, Orthopaedic Surgeon
■ G. Ode, MD, Orthopaedic Surgeon
■ R. Seymour, PhD, Associate Director of Orthopaedic Clinical Research
Carolinas Medical Center, 1025 Morehead Medical Drive, Suite 300 Charlotte, NC 28204, USA.

■ B. J. Jackson III, MD, Orthopaedic Surgeon
University of South Carolina, 2 Medical Park, Columbia, SC 29203, USA.

Correspondence should be sent to Dr E. N. Hanley; e-mail: Edward.Hanley@carolinashealthcare.org

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Coccydynia, defined as pain in the region of the coccyx, is an uncommon, controversial condition, for which the results following non-operative treatment are mixed.[1-4] When conservative treatment for chronic coccydynia has failed, coccygectomy may be considered, and favourable outcomes have been reported.[5-10] However, there is bias amongst orthopaedic surgeons, who dispute its effectiveness.

In this paper, we have evaluated the outcomes of the surgical management of patients with chronic coccydynia. We hypothesised that most patients with this condition would have objective improvement following total coccygectomy.

Patients and Methods

This is a prospective observational case series of patients who underwent total coccygectomy for chronic coccydinia.

Patients. Between September 2007 and August 2011, 317 patients with a diagnosis of coccydynia (ICD-9 code 724.79) were evaluated by the senior author (ENH) and screened for inclusion in the study. Patients were eligible for inclusion if they were aged > 18 years, had pain in the region of the coccyx and tenderness on examination, had persistent severe symptoms despite conservative treatment (including non-steroidal anti-inflammatory drugs (NSAIDs) or at least one sacrococcygeal injection) and had radiographic evidence of coccygeal abnormality as

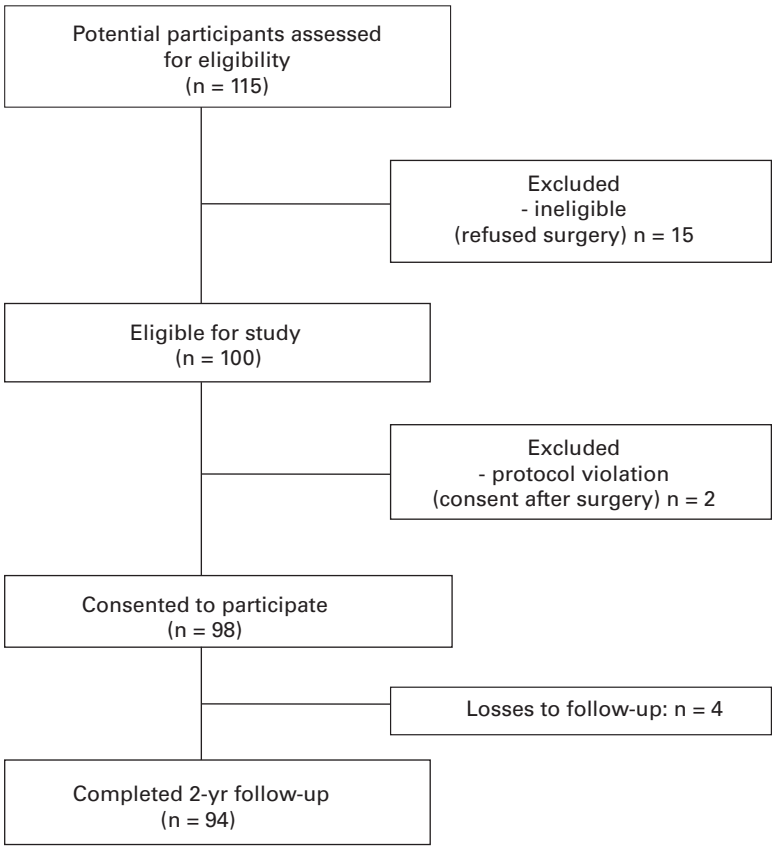

Fig. 1

Clinical flow diagram

described by Maigne et al.[11-13] As standard practice, all patients were offered the option of sacrococcygeal injection before consideration of coccygectomy. Patients with concomitant spinal disorders were included if there was no evidence that the spinal pathology was the cause of coccygeal pain. The study had ethical approval and all patients gave informed consent.

Surgical procedure. All operations were performed by the senior author (ENH) using the same technique. With the patient in the prone position, a midline longitudinal incision 5 cm in length was made in sacrococcygeal area. Electrocautery was used to expose the distal sacrum and coccyx subperiosteally. The entire coccyx was then removed. Fibrous tissue was left on the distal aspect of the sacrum in order to minimise the formation of ectopic bone. The wound was irrigated using pulsatile lavage with Bacitracin 50 000 units in 3L of normal saline solution. Haemostasis was achieved and the fascia and subcutaneous tissue were closed in two separate layers using interrupted number 1 and 2/0 Vicryl sutures, respectively. The skin was closed with interrupted 2/0 nylon sutures. The wound was covered with a waterproof adhesive dressing containing 1.2% ionic silver (Aquacel Ag, Skillman, New Jersey). All patients received an intravenous weight-based dose of Cefazolin peri-operatively and oral Sulfamethoxazole-Trimethoprim (800 mg-160 mg) and Cephalexin (500 mg) for five days post-operatively. No prophylaxis for venous thromboembolism was used.

Post-operative care. Patients were instructed to rest but not to sit for three weeks after surgery, at which time the sutures were removed. No lifting greater than 10 lbs. was allowed for three months.

Outcome measures and follow-up. The following details were recorded for each patient: age, body mass index (BMI), symptoms, treatment prior to surgery, and comorbid conditions including spinal pathology, and post-operative complications. The questionnaire included the Short Form 36 (SF-36), Oswestry Disability Index v2 (ODI), and the visual analogue scale pain indicator (VAS-PI). The SF-36 is a generic measure of health-related quality of life (HRQoL) that has validated use across several populations, including spine patients.[14,15] The VAS-PI, a widely used and reliable measure of pain, uses a physical range of 100 mm for determining pain intensity, ranging from zero (no pain) to 100 (very severe pain).[16,17] The ODI, designed to assess limitations of various activities of daily living (ADL), is the most commonly used condition-specific measure for spinal disorders and has a proven record of validity,

Table I. Characteristics of 98 patients who underwent coccygectomy for coccydynia

Gender (M/F)	11/87
Mean age (yrs) (SD, range)	47.2 (SD 13.0) (19 to 76)
Body mass index (kg/m^2) (SD, range)	27.0 (SD 6.6) (17.8 to 50.7)
Aetiology (n = 98) (%)	
Idiopathic	47 (*48.0*)
Trauma	35 (*35.7*)
Significant weight loss	8 (*8.2*)
Post-partum	7 (*7.1*)
Pelvic floor surgery	1 (*1.0*)
Injection therapy before surgery	70 (*71.4*)
Opiate use before surgery	45 (*45.9*)
Comorbid conditions	
Psychiatric	45 (*45.9*)
Major depression disorder	25 (*25.5*)
Anxiety disorder	23 (*23.5*)
Bipolar disorder	4 (*4.1*)
Post-traumatic stress disorder	2 (*2.0*)
Attention deficit-hyperactivity disorder	2 (*2.0*)
Obsessive compulsive disorder	2 (*2.0*)
Musculoskeletal	37 (*37.8*)
Lumbar spine pathology	17 (*17.3*)
Non-spine related (other musculoskeletal pain)	24 (*24.5*)
Fibromyalgia	3 (*3.1*)
Chronic pain syndrome	2 (*2.0*)
Cardiovascular	36 (*36.7*)
Neurological	33 (*33.7*)
Migraines	23 (*23.5*)
Endocrine	26 (*26.5*)
Haematological/immunological	18 (*18.4*)
Respiratory	18 (*18.4*)
Gastrointestinal	17 (*17.3*)
Genitourinary	12 (*13.9*)
Genitourinary pain (endometriosis, pudendal neuralgia)	3 (*3.1*)

reliability and responsivity. The index is scored from zero (no disability) to 100% (complete disability), with a score of 22 or higher considered an indication of significant ADL disability.[18,19]

Secondary subgroup analysis compared the outcomes and characteristics of patients with a successful outcome following coccygectomy with those whose treatment had failed. The threshold for successful treatment was based on a minimum clinically importance difference (MCID) of 20 points on the ODI at two years' follow-up and an overall ODI score of < 22 points.[18,19] Patients who did not meet this threshold or were lost to follow-up were classified as failure of treatment.

Statistical analysis. Descriptive statistics were calculated for all patient characteristic variables. The SF-36, ODI, VAS score were calculated for each patient. Repeated measures analysis of variance using generalised estimating equations (GEE) was used to compare three time points for the SF-36, ODI and VAS scores to account for correlated data. Statistical significance was set at $p = < 0.05$.

Results

A total of 115 patients with chronic coccydynia met the inclusion criteria and were treated surgically; 15 declined to enter the study and two patients who consented to enrollment after surgery were excluded. Thus 98 patients (87 women and 11 men) were included. Data were available for 84 patients at one year and 94 patients at two years post-operatively. Four patients were lost to follow-up. All outcome analyses were based on the 94 patients available two years post-operatively (Fig. 1).

Patient characteristics. The demographic details of the patients are summarised in Table I. The mean duration of symptoms was five years (three months to 50 years). A total of 89 patients (90.8%) had symptoms for > one year. Most (71.4%) had received a steroid injection prior to surgery and 45 (45.9%) took opiates for pain management. Among the 28 patients (28.4%) who refused steroid injections, the mean duration of symptoms was 6.9 years (one to 50). Three patients had symptoms for six months and had failed steroid injection therapy prior to coccygectomy. A total of 28 patients (28.6%) had a chronic pain syndrome with associated migraine, fibromyalgia or a genitourinary pain disorder.

Clinical outcomes. Table II shows the outcomes one and two years post-operatively. There were significant improvements in all ten components of the SF- 36v2 ($p < 0.05$).

The success of treatment. A total of 69 patients (70.4%) met the designated MCID threshold for a successful outcome. The remaining 29 patients were classified as failures

Table II. Patient outcomes pre-operatively and at one and two years post-operatively (n = 94)

	Baseline	1 Yr	2 Yrs	p-value
Short-Form-36v2				
Physical function	55.2 (48.7 to 61.8)	80.7 (74.7 to 86.7)	79.2 (73.8 to 84.7)	< 0.0001*
Role functioning – physical	30.2 (22.1 to 38.4)	69.4 (60.0 to 78.8)	70.1 (61.1 to 79.1)	< 0.0001*
Role functioning – emotional	54.2 (45.1 to 63.3)	87.0 (80.0 to 94.0)	73.4 (64.7 to 82.1)	< 0.0001*
Energy/fatigue	43.1 (38.2 to 47.9)	62.1 (56.8 to 67.2)	60.8 (56.0 to 65.6)	< 0.0001*
Emotional well-being	66.3 (62.0 to 70.5)	79.7 (75.8 to 83.7)	77.4 (73.4 to 81.5)	< 0.0001*
Social functioning	47.2 (42.1 to 52.3)	55.5 (51.3 to 59.6)	55.8 (51.9 to 59.7)	0.022*
Pain	40.0 (35.4 to 44.5)	70.3 (64.0 to 76.7)	71.8 (66.1 to 77.4)	< 0.0001*
General health	68.4 (64.4 to 72.4)	73.4 (68.6 to 78.2)	69.3 (64.5 to 74.2)	0.032*
Health change	45.3 (39.8 to 50.8)	81.4 (76.0 to 86.8)	74.5 (69.0 to 80.0)	< 0.0001*
Oswestry Disability Index	39.1 (35.2 to 42.9)	15.4 (11.3 to 19.5)	16.3 (12.6 to 19.9)	< 0.0001*
Visual analogue scale	59.1 (54.1 to 64.1)	19.4 (14.0 to 24.7)	20.3 (14.6 to 25.9)	< 0.0001*

* Indicates statistically significant difference at two years compared with baseline
Values are given as the mean, with 95% confidence intervals in parentheses

Table III. Comparison of the characteristics of patients in whom treatment was successful or failed

	Success group (n = 69) (%)	Failure group (n = 25) (%)	p-value
Injection therapy prior to surgery	47 (*68.1*)	23 (*79.3*)	0.263
Opiate pain medication use prior to surgery	26 (*37.7*)	19 (*65.5*)	0.011*
Comorbid conditions			
> 1 Comorbid conditions	40 (*57.9*)	22 (*75.9*)	0.094
> 3 Comorbid conditions	12 (*17.4*)	11 (*37.9*)	0.029*
Lumbar spine pathology	9 (*13.0*)	8 (*27.6*)	0.083
Musculoskeletal pathology (non-spine)	14 (*20.3*)	10 (*34.5*)	0.136
Psychiatric disorder	27 (*39*)	18 (*62.1*)	0.038*
Chronic pain syndrome	0 (*0*)	2 (*6.9*)	0.085
Fibromyalgia	3 (*4.4*)	1 (*3.5*)	1.000
Migraine headache	20 (*29.0*)	3 (*10.34*)	0.047*
Genitourinary pain disorder	1 (*1.5*)	2 (*6.9*)	0.208
Any pain disorder	22 (*31.9*)	6 (*20.7*)	0.263
Wound healing complication	13 (*18.8*)	6 (*20.7*)	0.832
Surgical site infection	4 (*5.8*)	1 (*3.45*)	1.000

* Indicates statistically significant difference between groups

of treatment: 25 (25.5%) had ODI scores that did not meet the MCID threshold and (4.1%) were lost to follow-up. Six patients (6.1%) classified as failures, had ODI scores that were no better or worse than the baseline. Two of the four patients lost to follow-up expressed dissatisfaction with the outcome at their last recorded visit and were included in the failure group, as it was assumed that an unsatisfactory outcome was the reason for loss to follow-up.

Comparisons of the characteristics and clinical outcomes of both groups are outlined in Tables III and IV. There was no significant difference in age, BMI, or comorbid conditions between the two groups. There was a significantly higher incidence of psychiatric disorders and opiate use prior to surgery, and a lower incidence of migraine, in the failure group. There was no significant difference between the groups in the rates of prior injection therapy, lumbar spinal pathology, non-spinal musculoskeletal pathology, genitourinary pain disorders or chronic pain syndrome. There was no significant difference in outcome for patients with less than three comorbid conditions. However, those with more than three comorbid conditions had a higher incidence of failed treatment.

Compared with the group in whom treatment was successful, the mean pre-operative ODI and VAS scores were significantly worse in those in whom treatment failed. The latter group also had significantly worse pre-operative SF-36 physical function, role functioning-physical, pain and general health scores. There was no significant difference in the pre-operative SF-36 Role functioning-emotional, energy/fatigue, emotional wellbeing, social functioning and health change scores. There was a mean clinical improvement in ODI score of 27.92 points in the success group, compared with 6.04 points in the failure group ($p < 0.0001$), two years post-operatively (Fig. 2). There was a mean improvement in the VAS score of 45.73 points in the success group compared with 18.92 points in the failure group ($p < 0.0001$). The failure group also had significantly less improvement in all SF-36 categories except social functioning ($p < 0.05$).

Complications. A total of 12 patients (12.2%) had post-operative complications requiring further surgery; 11(11.2%) had wound dehiscence requiring debridement. Five of these patients (5.1%) had local infection requiring irrigation and debridement and antibiotic treatment (Table V). The remaining six (5.5%) had wound dehiscence

Table IV. Comparison of outcomes in patients in whom treatment was successful or failed, two years post-operatively

	Success group (n = 69)	Failure group (n = 25)	p-value
Oswestry Disability Index			
Baseline	36.04 (31.17 to 40.9) (19.95)	44.8 (38.9 to 50.69) (15.50)	0.0381*
2 yrs	8.12 (5.34 to 10.89) (11.54)	38.76 (33.21 to 44.3) (13.44)	< 0.0001*
Visual analogue scale			
Baseline	55.74 (49.14 to 62.34)	67.52 (60.46 to 74.57)	0.0159*
2 Year	10.01 (5.03 to 15)	48.6 (38.05 to 59.15)	< 0.0001*
Short-Form-36v2			
Physical function			
Baseline	60.34 (52.28 to 68.39)	45.5 (34.01 to 56.98)	0.0403*
2 Year	88.31 (83.42 to 93.2)	54.22 (43.1 to 65.35)	< 0.0001*
Role functioning- physical			
Baseline	37.5 (26.98 to 48.02)	14.66 (2.87 to 26.44)	0.0112*
2 Year	85.02 (76.69 to 93.36)	29 (11.21 to 46.79)	< 0.0001*
Role functioning- emotional			
Baseline	59.09 (48.16 to 70.02)	44.83 (27.13 to 62.53)	0.1590
2 Year	84.06 (75.44 to 92.67)	44 (23.95 to 64.05)	< 0.0001*
Energy/fatigue			
Baseline	45.88 (39.79 to 51.98)	37.64 (29.15 to 46.14)	0.1281
2 Year	66.86 (62.05 to 71.67)	44 (33.61 to 54.39)	< 0.0001*
Emotional well-being			
Baseline	69.08 (64.31 to 73.84)	60.14 (50.76 to 69.51)	0.0605
2 Year	81.61 (77.46 to 85.75)	65.92 (56.3 to 75.54)	0.0006*
Social function			
Baseline	48.36 (42.27 to 54.44)	45.26 (34.98 to 55.54)	0.5863
2 Year	56.39 (52.33 to 60.46)	54.22 (43.76 to 64.68)	0.6936
Pain			
Baseline	44.19 (38.51 to 49.88)	31.47 (24.2 to 38.73)	0.0106*
2 Year	81.95 (76.18 to 87.71)	44(36.53 to 51.47)	< 0.0001*
General health			
Baseline	72.27 (67.83 to 76.72)	60.34 (52.13 to 68.56)	0.0064*
2 Year	74.64 (69.83 to 79.45)	54.6 (42.99 to 66.21)	0.0025*
Health change			
Baseline	48.11 (41.79 to 54.42)	40.52 (29.03 to 52)	0.2123
2 Year	81.16 (75.12 to 87.2)	56 (45.99 to 66.01)	< 0.0001*

* Indicates statistically significant difference between groups
Values are given as the mean, with 95% confidence intervals and SD (where applicable) in parentheses

alone without infection. Four of the five patients with a post-operative infection had a successful outcome two years post-operatively. The fifth had an early post-operative infection, which resolved with treatment but had a delayed wound dehiscence more than one year later. This patient developed a chronic sacral wound requiring excision and skin graft with a persistent but healing wound at the last visit. This patient had Sjogren's syndrome requiring immunosuppressive treatment at the time of the wound dehiscence. One patient (1.0%) required further surgery to excise a residual first coccygeal segment. An additional eight patients (8.2%) had minor delayed wound healing requiring topical wound care only. These wounds healed rapidly. The incidence of complications, wound dehiscence, infection or minor delayed wound healing did not differ significantly between the groups (Table II).

Discussion

This is the largest prospective study evaluating coccygectomy for the treatment of chronic coccydynia. We found that this procedure resulted in significant improvement in function, disability-related outcomes, QoL and pain two years post-operatively for most patients. To date, there is no established threshold for the MCID of any clinical outcome measures used following coccygectomy. Previous prospective studies evaluating coccygectomy have reported good or excellent outcomes ranging from 68% to 92% in studies with 28 to 37 subjects.[12,20-22] However, objective outcome measures were rarely used and the criteria for 'good' or 'excellent' were often based solely on clinical judgment. A distribution-based MCID may be determined by using a one half standard deviation benchmark to quantify a moderate effect size. In this study, a *post hoc* calculation of the distribution-based MCID for the ODI for the group with a

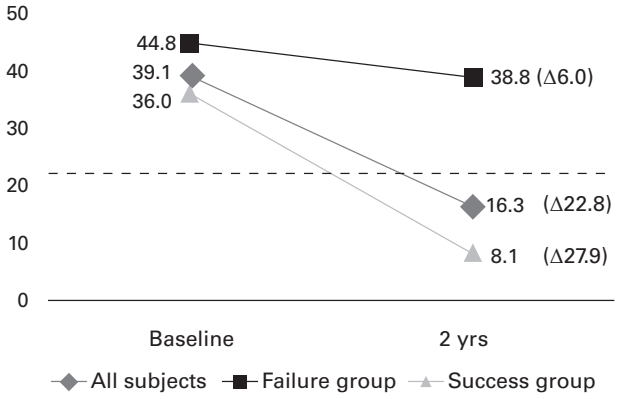

Fig. 2

Graph showing change in Oswestry Disability Index (ODI) Score by outcome (successful outcome = ODI score below 22 points and change from baseline of 20 + points)

successful outcome at two years would be 5.77. This threshold was not felt to be rigorous enough to be clinically relevant. In the recent literature dealing with surgery to the lumbar spine, distribution-based MCID calculations for the ODI have ranged from 6.8 points for extension of fusion for adjacent segment disease[23] to 14.9 points for transforaminal lumbar interbody fusion for degenerative spondylolisthesis.[24] One study has suggested a threshold for minimally acceptable outcomes of 20 points in the ODI for spinal fusion,[19] which is nearly four times the MCID in our study. This 20-point difference with an overall ODI score of < 22 points provided us the most rigorous benchmark for improvement. The operation was deemed to be successful in 70.4% of patients using these criteria. In order to validate the clinical relevance of our threshold, we compared the outcomes of our 'success' and 'failure' groups. Patients classified as 'successes' based on the ODI score threshold also had VAS-PI scores and SF-36 scores that were significantly better than the 'failure' group. Previous studies evaluating low back pain and sciatica have suggested that VAS-PI improvement to a score of < 30 (of 100) best discriminates between patients in whom treatment is successful with recovery or significant improvement, or not.[16] The mean VAS scores for our 'success' and 'failure' groups were 10.01 and 48.6 post-operatively, respectively. A recent systematic review of responsiveness of patient-reported outcome measures (PROMS) for pain, function and HRQoL in lumbar spinal surgery, reported that VAS pain and ODI were the measures that were the most treatment specific and the most responsive to change post-operatively.[25] This further supports the 20-point change and < 22 point total score in ODI as a clinically important measure of the success of treatment in patients who undergo coccygectomy.

The indications for coccygectomy are difficult to define as the cause of coccydynia in many patients is unknown. Neurosis and/or psychiatric disorders have often been associated with coccydynia or thought to be a contributing or magnifying factor.[13,26,27] Several authors have also postulated that if there was a psychogenic aetiology for coccydynia, it may contribute to poorer outcomes following surgical treatment.[7,28,29] However, many patients with spinal symptoms also have psychiatric disorders. In a series of 200 patients, Polatin et al[30] reported that 59% with low back pain had evidence of a psychiatric disorder, which is higher than our rate of 45.9% in patients with coccydynia. Furthermore, while psychiatric disorders are a well-known risk factor for impaired QoL and poor long-term functional outcomes following spinal surgery,[31-33] they have not been objectively evaluated as a risk factor for poor outcomes following coccygectomy. In our subset analysis, patients with poor outcomes following coccygectomy had a higher incidence of psychiatric disorders pre-operatively. However, patients with poor outcomes also had worse QoL features, a higher incidence of multiple comorbid diseases, higher VAS pain scores and a higher incidence of opiate use, pre-operatively. Indeed, many patients in the success group had psychiatric illness and still had satisfactory results. Moreover, patients with many comorbid conditions may have experienced a 'ceiling effect' and had reached a plateau with treatment, which may have limited quantifiable changes in outcome measures assessing improvement in function and QoL. Therefore, we cannot definitively conclude that specific pre-operative characteristics are related to poorer outcomes following coccygectomy. It is more likely that pain and musculoskeletal impairment in these patients is multifactorial and may not improve significantly with surgery for one condition. Indeed, 19 out of 25 of our patients who did not meet the MCID threshold had some improvement, although not to a level of clinical relevance. Patients with pre-operative characteristics such as psychiatric symptoms or comorbid conditions, or higher pain scores, need to be made aware that they may have less improvement after coccygectomy than a patient without these characteristics. In our series, 11 patients (11.2%) had

Table V. Description of the five patients with post-operative infection.

Outcome group	Age/ gender	BMI	Injection therapy (Y/N)	Micro-organism	Course of treatment
Success	47/F	26	Y	*E. Coli;* Methicillin-sensitive *S. aureus* (MSSA)	Early post-operative infection (4 wks) requiring surgical debridement then treated with a three week course of oral organism-specific antibiotics.Final outcome: Complete healing.
Success	48/F	22	Y	*Citrobacter koseri,* MSSA; Mixed gram-negative anaerobes	Early post-operative infection (4 wks) requiring surgical debridement then treated with a 2 wk course of organism-specific IV antibiotics for 2 wks followed by a 3 wks course of oral antibiotics. Final outcome: Complete healing
Success	35/F	20	N	Methicillin-resistant *S. Aureus*	Early post-operative infection (4 wks) requiring surgical debridement then treated with a two wk course oral organism-specific antibiotics. Final outcome: Complete healing.
Success	36/F	37	N	Unknown	Purulent non-healing wound at 3 mths requiring surgical debridement, wound vac placement and a 2 wk course of empiric oral antibiotics.Persistent wound at 4 mths prompted plastic surgery referral for debridement and unilateral V-Y flap reconstruction of sacral defect. Staged skin graft at 5 mths. Final outcome: Complete healing.
Failure	33/F	20	Y	Coagulase-negative *S. Aureus; Diptheroides*	Early post-operative infection (4 wks) treated with a 2 wk course of oral organism-specific antibiotics with initial uneventful complete healing. Returned with aseptic wound dehiscence 18 mths out from surgery requiring debridement and revision closure. During this time a new diagnosis of Sjogren's disease was made and the patient was treated with immunosuppressive therapy.Intermittent draining wound at 25 mths requiring referral to plastic surgeon for debridement. Staged closure and skin graft at 26 mths. Final outcome: Minor breakdown at 28 mths requiring third debridement then local wound care for slow healing wound.

MSSA, Methicillin-sensitive *staphylococcus aureaus*; BMI, body mass index

a wound infection or dehiscence. However, these patients did not have a significantly poorer outcome. A recent systematic review of 671 coccygectomy patients, reported a complication rate following coccygectomy of 10.9%[34] Most were wound problems that resolved with antibiotics and local treatment.[6,9,10,21,35,36]

This study is a prospective analysis of a large series of patients treated by a single surgeon with extensive experience with the procedure. It reinforces the argument that patients with chronic coccydynia can benefit from surgical intervention. A weakness of this study is the lack of a non-operative comparison group. More than 90% of patients in this study had symptoms for more than one year and more than 71% had already failed injection therapy. Although we cannot predict that our patients would not have improved with continued non-operative care, the duration and severity of their symptoms made inclusion in the surgical study appropriate.

In conclusion, coccygectomy is a moderately successful form of treatment for patients with chronic coccydynia. The risks of wound healing complications are substantial, but these risks do not appear to affect the ultimate outcome. As part of the informed consent process, patients should be told of the risk of these complications and the potentially poorer outcomes with certain comorbidities, but that most will achieve a satisfactory outcome.

Author contributions:
E. N. Hanley: Hypothesis, writing the paper, data collection, study design.
G. Ode: Writing the paper, data collection.
B. J. Jackson III: Writing the paper, data collection.
R. Seymour: Writing the paper, data collection.

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