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Coccydynia Systematic Review

Mohamed Nashaat Ahmed Gaafar[1], Abdelhamid Abdulaziz Attalah[1] and Abdelkhalek Abd-Elghafaar Al-Zalabany[1]

[1]Department of Orthopedic Surgery, Faculty of Medicine for Girls, Al-Azhar University, Cairo, Egypt.

***E-mail: Gaffarinho@yahoo.com**

Abstract

Coccydynia (Coccygodynia) a term that used to indicate pain–discomfort all around the lower end of the spine. Various methods of coccydynia therapy are found in the literature, but the effectiveness of either surgical or conservative treatment remains obscure. A systematic literature review of research studies using PubMed.com., MEDLINE, Google Scholar and Scopus, between the year 2000 and January 2021. Thirty-one manuscripts (21surgical interventions & 10 conservative interventions) were analyzed including 914 patients (618 surgical interventions & 296 conservative interventions). examining the various surgical and traditional interventions for coccydynia and their efficacy. The majority of analyzed twenty-one surgical interventions manuscripts were retrospective series and only three were prospective series. Five were divided according to LOE as Level III studies. The most familiar reason was direct trauma (56.5%). Excellent result after the procedure was reported in (82.5%) of the patients. The total complication rate was 11.3% & the most common reported complication was wound infection. The ten conservative interventions papers had three randomized controlled trials (RCTs) and seven observational studies. Manual therapy improves VAS scores and sitting time without pain in 22% of the patients. Injections were effective in 75% of patients & VAS score reduced from 8.5 to 2.5 after two injections. Numerous conservative therapies may be beneficial in lowering the discomfort associated with coccydynia, but further study is required. Coccygectomy looks to be a viable surgical option for individuals who do not improve with conservative therapy.

Keywords: Coccydynia-Coccyx-Surgical-Conservative-Treatment.

1. Introduction

Systemic Simpson used the word coccydynia in 1859 to refer to discomfort and tenderness at the base of the spine and is frequently aggravated by long sitting [1]. The origin and severity of the symptoms may vary considerably. It may be caused by acute trauma, repeated damage, childbirth, local tumors, or disc degeneration, or it may be idiopathic [1-4,34] Although the actual pathophysiologic processes behind coccygodynia remain unknown, Obesity is regarded as a risk factor because of the consequent pelvic rotation [2]. Coccygodynia has been reported to be greater prevalent in females, with an incidence rate five times that of men. This

has been attributed to gender-specific anatomical characteristics [3,4]. Additionally, clinical symptoms have been found to be amplified by psychological despair, neurosis, or hysteria, amplifies the clinical manifestations [5,6] Additionally, teenagers and adults are more frequently affected than children [2,5]. Coccydynia is diagnosed using a combination of patient demographic data and medical research. Typically, sitting causes coccyx discomfort. Palpation can detect tenderness and hypermobility of coccygeal. Rectal examination may reveal pain [3]. Typically, radiological examinations are conducted using lateral sacral radiographs, which enable categorization of the coccyx's morphology based on its inclination [7]. (Table 1).Patients with a type II-IV coccyx are more likely than those with a type I coccyx to develop idiopathic coccygodynia. Additionally, the usage of dynamic X-rays for comparing radiographs taken standing and sitting has been demonstrated to be beneficial [2,8]. (Table 1). MRI and bone scintigraphy can help rule out the existence of degenerative spine disease, pathology of local tumor, and metastatic bone disease [9]. Most cases of coccydynia can be managed conservatively, with up to a 90% cure rate, using non-steroidal anti-inflammatory drugs (NSAIDs), changing one's sitting style, Coccygeal cushions, pelvic floor rehabilitation, transcutaneous electrical nerve stimulation (TENS), extracorporeal shock wave therapy (ESWT), and physical therapy are all used to treat coccygeal pain. Only a few instances that do not resolve with conservative therapy require intrusive intervention, which may include surgical and non-surgical procedures [6-9].

Coccygectomy is recommended as a definitive surgical remedy in situations of chronic symptoms that do not respond to conservative therapy. Two distinct surgical resection techniques have been documented.(Table 2). The aim of this work was to assess the advanced issues in coccydynia therapy, determine their effectiveness either surgical or non-surgical interventions

Table 1: Radiographic classifications of the coccyx.

Postacchini and Massobrio classification [7]	Maigne et al. evaluation [2,8,9]
Type I: Slightly forward curvature of the coccyx	Type I: Curving over 25 degrees
Type II: More markedly curved, with the coccyx pointing straight forward	Type II: Displaced or subluxated posteriorly
Type III: Sharply angled anteriorly	Type III: With a spicule on the dorsal surface of the last coccygeal segment, immobile.
Type IV: Subluxation of the sacrococcygeal or intercoccygeal joints	

Table 2: Surgical suggestions for coccygectomy.

Gardner [11].	Coccygectomy conducted from distal (tip) to proximal has the drawback of the surgeon operating blindly, which raises the risk of rectal injury.
Key [10]	From proximal to distal coccygectomy
Bilgic et al. [12]	Coccygectomy is less common than sub-periosteal resection
Postacchini and Massobrio[7]	The coccyx can be eliminated with equivalent success results.

2. Patients and Methods

A systematic literature retrieval was conducted in PubMed.com., MEDLINE, Google Scholar and Scopus by using (Coccydynia-Coccyx-Surgical-Conservative-Treatment) as key words. Original peer-reviewed English articles addressing chronic coccydynia treatment in adults were eligible for inclusion (≥ 18 years), between the year 2000 and January 2021, in randomized controlled trials (RCTS), cohort studies, or case series with a minimum of five patients with coccydynia that are published in full text retrospectively and prospectively. Case reports, editorials, and case series including tumors were not included in the study. The PICO model was utilized to guide the search approach to discover relevant studies: population, intervention, comparison, and finding measurements.
Seventy-five manuscripts were initially identified. Additional research was conducted using the references in the papers. , in total 31 manuscripts (21surgical interventions&10conservativeinterventions) were analyzed including 914 patients (618surgicalinterventions&296conservativeinterventions)according to the data providing: Study type, Level Of Evidence(LOE), count of patients, age and gender characteristics, symptom duration, aetiology, categorization, intervention type , usage of antibiotics or drain, follow-up period, results, effectiveness and complications. Data extraction, meta-analysis & quality assessment was conducted. Clinical outcomes were graded as excellent or good (patients with minimal occasional discomfort), acceptable (Symptoms that are chronic or worsening.
The analysis was conducted using the Statistical Package for the Social Sciences (SPSS), version 20 (Inc., Chicago, IL, USA). Continuous data were averaged, and standard deviations determined, whilst variables that are categorical were expressed as frequencies and percentages. The Chi-square test was used to see if a link existed between the two surgical procedures and the postoperative outcome and complication rate. Odds ratios (OR) and 95% confidence intervals (CI) were calculated for the connections using simple logistic regression analysis. The statistical significance of all tests was determined for p values <0.05.

3. Results

As shown in table 3 twenty-one surgical interventions manuscripts were analyzed, the majority were retrospective uncontrolled case series and only three [13,31,32] were prospective series. Five were divided according to LOE as Level III studies [13,18,21,31,32]. Totally, 618 individuals with coccygodynia had coccygectomy as final pain treatment were included in the examined series. The average age of those series was from 26.4 [12] to 52.8 years, [20] while the age extremes were between11[21] and 80[29] years. Most of the patients were females (511 patients, 82.7%), while males were only 107 (17.3%), evaluating the ratio of male/female 1/4.8. In 446 cases, the aetiology of coccygodynia was documented [14,15,17,24,26,27,12,28-32]. and the most often reason was direct trauma, recorded in 252 cases (56.5%), idiopathic in 140 cases (31.4%), childbirth & post-partum in 34 females (7.6%), surgery, instability &weight loss in 20cases (4.5%). This study revealed that 510 patients who underwent coccygectomy had excellent or satisfactory prognosis. (82.5%), 61 patients were fair (9.8%) and 47 bad results (7.6%). Some of the authors [12, 14, 16, 17, 21, 23, 26, 27] used VAS (28) to evaluate their results. Perkins et al. (14) and Hodges et al. [17] showed a reduced of VAS from 8.3 to 4.5 and 7.3 to 3.6, respectively. Cebesoy et al. [26] Additionally, the evolution of VAS decrease through time was discussed, from 51.8 pre-operatively to 3.18 at six months and 2.94 and 2.76 at twelve and twenty-four months, respectively. As show in table 4 the operation carried out was well described in the majority of the papers;

Numerous surgeons favor exposure to surgery like that described by Key.(10)It is stated clearly in seven studies.[14–16, 18, 24, 25,32]The doctors recommended preoperative pharmacological constipation, a minimal residual diet, fleet enema and intravenous second generation cephalosporin one day before surgery. The patients had general anesthesia with buttocks separated and secured laterally in prone position to facilitate the exposure. From the sacrum to the coccyx, a longitudinal incision was created. They performed a partial or complete coccygectomy. It was appropriate to retain ligamentous and muscular attachments, as well as the periosteum.[12, 15, 27] Postacchini and Massobrio (7) classification was used in five studies.[18–20, 24, 32] In total, analysis of 145 X-rays were, 56 type I (38.6%), 46 type II (31.7%), 27 type III (18.6%) and 16 type IV (11.1%).[13, 14, 18] Several investigations compared the subluxation and hypermobile coccyx, indicating a slight preference for the subluxation type over hypermobility, although not statistically significant.[13, 16, 23]Patients were followed for an average of one month[28,31] to 29 years [32]after surgery, with the great majority of researches averaging more than two years of follow-up. Antibiotic usage postoperatively was documented in twelve studies. In six papers [16–18, 24, 25, 12] For 48 hours, a second generation cephalosporin was administrated after operation, while the remainder of the researches differ significantly regarding the type and length of chemoprophylaxis .Some studies [13, 16,30,32]have documented the importance of a drain to evade the vacant space that may affect the findings. On the other side, many authors [18, 22, 23, 25] advised against the use of a drain, arguing that its closeness to the rectus muscle may contribute to an increased infection rate. All except one study stated postoperative complications. [20] The total rate of complication was 11.3%,(ranged from0 to 50 %). [26, 27] Seventy cases (11.3%) reported wound infections: 26 superficial, 5 deep, 26 not classified,10 (1.6%) wounds dehiscence (further surgical managing) and 3(0.5%) healings that are delayed with persistent drainage. All treated with antibiotics and one with surgical debridement. Escherichia coli [12, 21] and Staphylococcus aureus [16] were the microorganisms with the most often reported microbiological findings. It was noteworthy that the short series (15, 17, 18) had high complication rates (26.7%, 36.3% & 30% respectively). As shown in table 5 the ten selected conservative interventions papers included three (RCTs) and seven observational studies. LOE varied from moderate to extremely low. Totally, the assessed series included 296 cases with conservative pain management for coccygodynia. The mean age ranged from 31.1[39] to 49.2 years, [37] while the extremes of the age ranged between 16 and 86years. [40] Females represent (56.4%), and the etiology was direct trauma in (52.3%) of cases. Follow-up occurred between 10 days to 9 months, and result measurements involved: the visual analog scale (VAS). (33-35, 38-41) [37] numeric pain rating scale (NPRS), [36, 42] EQ-5D, [37] McGill pain questionnaire, [33] Nirschl pain phase scale, [35] pain-free sitting time, [39] infrared thermography (IRT), [36] Paris questionnaire and Dallas pain questionnaire. [33] The investigations comprised the following interventions: intrarectal manipulation with massage [33] and with phonophoresis, transcutaneous (TENS), and analgesics. [39], [36] steroid injection, [34] dextrose prolotherapy, [35] chemical neurolysis, [38] RFT of ganglion impar [37] and (ESWT). [40,42]. Manual interventions: Patients who underwent coccygectomy had an excellentor satisfactory prognosis: Khatri et al. [39] When intrarectal manipulation associated with phonophoresis and TENS was compared to phonophoresis and TENS alone, a statistically significant enhancement in VAS ratings and sitting

time without discomfort was seen in individuals undergoing intrarectal manipulation. Maigne et al. [33] Utilizing a unique global score, we compared the effectiveness intrarectal manipulation coupled with levatorani massage vs short-wave diathermy in the treatment of persistent coccydynia. The VAS, the McGill pain questionnaire, the Paris questionnaire, and the modified Dallas pain questionnaire were combined to get the global score. At six months, they discovered that 22% of cases in the manual therapy group compared to 12% in the control group had an excellent result, defined as ≥50% reduction in individual global score at one month and ≥60% at six months.Wu et al. [36] The physiologic response of patients was evaluated pre and post manual therapy coupled with short-wave diathermy. At 12 weeks, they discovered significant variations in both the NPRS, and the surface temperature measured using IRT.A significant association between the enhancement of the NPRS and the drop in surface temperature was found. Each of the three trials showed a significant reduction in pain. Injections: Three trials evaluated the useful of injections for coccydynia therapy. Datir and Connell [38] When the efficacy of injection CT-guided steroid to immobilize the ganglion was evaluated, it was shown that 75% of patients experienced total or partial pain alleviated at the 6-month follow-up without requiring additional pain medication. Mitra et al. [34] studied the usage of fluoroscopic guided steroid injection and found that individuals within the first six months of coccydynia reacted better to the injection than those with a longer period of coccydynia, but the difference was not statistically significant. Khan et al. [35] presented the benefits of dextrose prolotherapy were evaluated in individuals who had failed to react to conservative therapies for more than six months. After two injections, the mean VAS score reduced from 8.5 to 2.5. (ESWT): Three research examined the utilization of ESWT for coccydynia. Line et al. [40] revealed showed patients in the ESWT group had greater satisfaction levels, with 70% indicating good to excellent satisfaction, and that the ESWT group scored considerably higher than the SIT group. ($p<0.003$). After 6 months of follow-up, 90.2% improvement (VAS<4) in Adas et al. study. [41] While Marwan et al. [42] After six months of follow-up, the median numerical pain scale for 17 patients with coccydynia dropped significantly from 7.0 ± 4.0 to 2.0 ± 2.0. ($p<0.001$). The median Oswestry disability index enhanced from 24.0±9.0 before therapy to 8.0±9.0 at final follow-up ($p<0.001$). Radiofrequency interventions: One research examined the application of RFT for coccydynia. Demircay et al. [37] employed RFT to assess the ganglion impar and found considerable enhancement in VNS and EQ-5D scores after six months.

Table 3: Systematic review data of surgical interventions studies.

	Authors (Year)	Study Design	LOE	No. of Patients (618) (F%)	Age (Range)	Aetiology	Duration of symptoms	Clinical outcome			Effect-iveness (%)
								Excellent + good	Fair	Poor	
1	Maigne et al. [13] (2000)	Pro	III	37 (75.6%)	46.5 (30–64)	n/s	31 months	34	–	3	92
2	Perkins et al. (14) (2003)	Retro	IV	13 (69.2%)	45 (24–72)	7 trauma/6 idiopathic	32 (9–44) months	7	4	2	92.3
3	Ramsey et al. (15) (2003)	Retro	IV	15 (93.3%)	32 n/s	5 trauma/8 idiopathic/2 childbirth	n/s	13	–	2	86.7
4	Doursounian et al. (16) (2004)	Retro	IV	61 (80.3)	45.3 (18–72)	n/s	30 (2–28) months	53	1	7	87
5	Hodges et al. (17) (2004)	Retro	IV	11 (72.7%)	47 (23–72)	9 trauma/2 idiopathic	6 months	9	1	1	82
6	Wood and Mehbod(18) (2004)	Retro	III	20 (80)	41 (22–66)	14 trauma/ 1idiopathic/5 childbirth	22 (14–47) months	18	2	0	90
7	Karalezli et al. (19) (2004)	Retro	IV	14 (100%)	28 (17–39)	8 trauma/3 idiopathic /3 childbirth	n/s	12	1	1	85.7
8	Feldbrin et al. (20) (2005)	Retro	IV	9 (77.8%)	52.8 (21–65)	4 trauma/3 idiopathic/2 childbirth	4 months–2 years	6	1	2	67
9	Pennekamp et al. (21) (2005)	Retro	III	16 (87.5)	39.8 (11–75)	8 trauma/8 idiopathic	n/s	10	4	2	62.5
10	Balain et al. (22) (2006)	Retro	IV	38 (81.6%)	47.3 (15–71)	22 trauma/13 idiopathic/ 3 childbirth	n/s	22	9	7	71
11	Mouhsine et al. (23) (2006)	Retro	IV	15 (60%)	44.2 (33–58)	All trauma	6 months	14	1	–	93.3
12	Capar et al. (24) (2007)	Retro	IV	24 (95.8%)	33 (21–60)	18 trauma/6 idiopathic	14–144 months	20	2	2	83.3
13	Sehirlioglou et al. (25) (2007)	Retro	IV	74 (86.5%)	43.4 (16–45)	n/s	7 (3–12) months	71	–	3	96
14	Cebesoy et al. (26) (2007)	Retro	IV	21 (71.4%)	31 (28–39)	19 trauma/2 childbirth	8 (6–10) months	21	–	–	100
15	Traub et al. (27) (2009)	Retro	IV	8 (75%)	47.3 n/s	5 trauma/3 idiopathic	15.2 months	7	1	–	87.5
16	Bilgic et al. (12) (2010)	Retro	IV	25 (60%)	26.4 (20–39)	17 trauma/8 instability	10 (8–13) months	21	1	3	84
17	Trollegaard et al. (28) 2010	Retro	IV	41 (95.1)	39.1 (16.77)	21 trauma/12 idiopathic/8 postpartum	1-42 months	33	5	3	80.5
18	Kerr et al. (29) 2011	Retro	IV	26 (73.1%)	49.1 (25-80)	18 trauma/8 idiopathic	24 months	22	2	2	84.6
19	Haddad et al. (30) (2014)	Retro	IV	14 (85.7%)	39.4 (12-74)	8 trauma/3 idiopathic/1 postpartum/ 2 surgery	18-84 months	12	1	1	85.7
20	Hanley et al. (31) (2016)	Pro	III	98 (88.8%)	47.2 (19-76)	35 trauma/47 idiopathic/7 post-partum/ 8 weight loss/1 surgery	3 months-50 years	69	25	4	70.4
21	Hochgatterer et al. (32) (2021)	Pro	III	38 (84.2%)	36.7 (13-68)	19 trauma/17 idiopathic/1 childbirth / 1 surgery	6 months	36	-	2	94.7
								510	61	47	82.5%

Table 4: Peri-operative data of surgical interventions studies.

	Authors (Year)	Operation	Classifi-cation	Drain	Antibiotics	Follow up	Complications	
							Type	(%)
1	Maigne et al. (13) (2000)	Described	Maigne	Yes	n/s	12-24 months	3 infections	8.1
2	Perkins et al. (14) (2003)	Key	n/s	n/s	n/s	43 months (19–74)	1 superficial infection, 1 wound dehiscence	15.4
3	Ramsey et al. (15) (2003)	7 Key / 8 partial	n/s	n/s	1 pre: 1 post-operative	14 months (6–24)	4 superficial infections	26.7
4	Doursounian et al. (16) (2004)	Key	Maigne	Yes	2ndgeneration/48 h	12 months	9 infections (5 staph aureus)	14.7
5	Hodges et al. (17) (2004)	n/s	n/s	n/s	2ndgeneration/ gentamycin	28 months (12–70)	3 infections/1 wound dehiscence	36.3
6	Wood and Mehbod(18) (2004)	Key	Postacchini	No	2nd generation/48 h	26 months (12–59 months)	3 superficial infection/3 persistent drainage	30
7	Karalezli et al. (19) (2004)	11Tota / 3 partial	Postacchini	n/s	n/s	30 months (4–48)	2 superficial infections	14.3
8	Feldbrin et al. (20) (2005)	n/s	Postacchini	n/s	n/s	Minimum 12 months	n/s	–
9	Pennekamp et al. (21) (2005)	Sub-periosteal	n/s	n/s	1–3 days	7.3 years (2–16)	2 superficial /1 deep infections (with E. coli)	18.8
10	Balain et al. (22) (2006)	n/s	n/s	No	n/s	6.7 years (2–16)	1 superficial infection	2.6
11	Mouhsine et al. (23) (2006)	Partial	Maigne	No	n/s	2.8 years (14 months–6 years)	1 superficial infection	6.8
12	Capar et al. (24) (2007)	Key	Postacchini	n/s	2nd generation and aminoglycoside/72 h	Minimum 9 months	2 infections	8.3
13	Sehirlioglou et al. (25) (2007)	Key	n/s	No	2nd generation/48 h	4.1 years (2–8)	4 superficial infections /1 deep infections	6.7
14	Cebesoy et al. (26) (2007)	n/s	n/s	n/s	For 5 days post op	26 months (24–32)	No	0
15	Traub et al. (27) (2009)	Described	n/s	n/s	1 dose	21.7 months	4 Dehiscence (1 re-operated)	50
16	Bilgic et al. (12) (2010)	11 Total /14subperiost	n/s	n/s	2nd generation/48 h	20.4 months (12-36)	2 superficial infections, 2 deep infections (with E. coli)	16
17	Trollegaard et al. (28) 2010	Described	n/s	n/s	IV cefuroxime per-operatively	1-42 months	5 superficial infections	12.2
18	Kerr et al. (29) 2011	Described	n/s	n/s	n/s	37 (2-133)	3 infections	11.5
19	Haddad et al. (30) (2014)	Described	n/s	Yes	n/s	24-132	1 infection (wound oozing)	7.1
20	Hanley et al. (31) (2016)	n/s	n/s	n/s	n/s	1 month- 2 years	6 wound dehiscence/5 infections	11.2
21	Hochgatterer et al. (32) (2021)	Key	Postacchini	Yes	Single shot Cefazoline	2 months- 29 years	1 superficial infection/1 reoperation	5.3

n/s=not stated

Table 5: Systematic review data of conservative interventions studies

	Authors (Year)	Study Design	LOE	No. of Pts (**296**) (F%)	Age (Range)	Aetiology	Duration of symptoms	Conservative intervention	Effectiveness & 95% CI
1	Maigne et al. (33) (2006)	RT	M	51 (+51 Controls) (45.1%)	45.2 (25-70)	Trauma (18%) Unspecified (82%)	>2 months	Intrarectal manipulation, massage (External Physiotherapy)	At 6 months, 22% improvement in experimental group vs 12% in control group; 95% CI: 6.5–22.2%; P=0.18
2	Mitra et al. (34) (2007)	O	VL	14 (50%)	43 (34-64)	Trauma (58%) Unspecified (42%)	<6 months in three subjects; >6 months in 11 subjects	Steroid injection	Combined group VAS improvement (P=0.64)
3	Khan et al. (35) (2008)	O	L	37 (62.2%)	36 (NS)	Idiopathic (100%)	>6 months	Dextrose prolotherapy	Mean VAS decreased 8.5–3.4 (first injection) to 2.5 (second injection). Minimal or no improvement was noted in seven patients.
4	Wu et al. (36) (2009)	O	L	53 (88.7%)	39.4 (18-71)	Trauma (79%) Unspecified (21%)	>1 month	Intrarectal manipulation, massage, diathermy	At 12 weeks, mean numeric pain rating scale (NPRS) decreased from 6.15 to 2.7 (P<0.05) and mean pericoccygeal surface temperature decreased from 30.16 C to 28.7 C (P<0.05). Significantly marked level of correlation between NPRS improvement and temperature decrease (r=0.67, P<0.01)
5	Demircay et al. (37) (2010)	O	VL	10 (80%)	**49.2** (22-77)	Trauma (40%) Unspecified (60%)	>6 months	Radiofrequency Thermocoagulation (RFT)	Mean visual numeric scale (VNS) 8.7 (±0.67) to 2.1 (±0.87) at 1 month to 2.9 (±1.28) at 6 months. EQ-5D 4.4 (±0.51) to 7.5 (±1.08) at 1

									month to 6.6 (±1.26) at 6 months.
6	Datir and Connell(38) (2010)	O	VL	8 (37.5%)	33.1 (22-44)	Trauma (100%)	>1 year	Chemical neurolysis	At 6 months, three patients with complete pain relief, three with partial relief, and two with no relief. Mean VAS decreased 8–2 in six of the eight patients.
7	Khatri et al. (39) (2011)	RT	M	18 (+18Controls) (NS)	**31.1** (20-55)	Idiopathic (100%)	15 days-2 years	Intrarectal manipulation, phonophoresis, trans-cutaneous electrical nerve stimulation (TENS), analgesics	Mean visual analog scale (VAS) decrease by 5.3 experimental vs 1.4 control (P=0.0001). Mean pain-free sitting time: 47 minutes experimental vs 23 minutes control (P=0.0002)
8	Line et al. (40) (2015)	RT	M	41 (73.2%)	44.7 (**16-86**)	Trauma (100%)	>11 months	Extracorporeal shock wave therapy (ESWT)	The patients in the ESWT group had better subjective satisfaction scores, with 70% reporting good to excellent satisfaction. The scores were significantly higher in the ESWT group than in the SIT group (p = 0.003
9	Adas et al. (41) (2016)	Retro	L	41 (70.7)	46.7 (28-67)	Trauma (51.2%) Idiopathic (29.3%) Child Birth (7.3%) Malignancy (12.2%)	3 years< 10 Months	Transsacrococcygeal approach to ganglion impar:	After 6 months of follow-up, 90.2% Successful (VAS <4)
10	Marwan et al. (42) (2017)	Pro	**M**	23 (56.5)	38.3 (18-64)	Trauma (74%) Unspecified (26%)	6 weeks	Extracorporeal shock wave therapy (ESWT)	After 6 months of follow-up, the median numerical pain scale significantly decreased from 7.0 ± 4.0 to 2.0 ± 2.0 among the 17 patients with coccydynia (p \ 0.001). The median Oswestry

									disability index improved from 24.0 ± 9.0 before therapy to 8.0 ± 9.0 at final follow-up (p \ 0.001).

4. Discussion

Coccygodynia is a very uncommon ailment that is typically caused by recurrent trauma, postpartum, or idiopathic causes. In certain cases, it may be a referred pain caused by degeneration of the lumbar spine.[2–6, 43]Unfortunately, the studied twenty one surgical series lacked strength in terms of evidence, our analysis and findings inherit these flaws and the disappearance of a full meta-analysis of the data because of the broad disparities in the methodology utilized. Additionally, the effects of coccygectomy were determined using subjective assessment tools such as the VAS and ODI(44) without documented outcomes that could indicate & authorize the efficacy of operation. Also, it was challenging to establish a strategy for evaluating the relationship between postoperative results and clinical finding. Although the drawbacks listed above, numerous important conclusions may be drawn.

They showed that to be a sex dominance, as coccygodynia typically affects women in their prime from 1920 to 1950. [3] The cause for this has been accredited to the female sacral anatomy's idiosyncrasies. [4] In terms of causation, trauma (local injury) was identified as the most often occurring aetiological component in up to 56.5 percent of cases in this review. Kim and Suk [45] presented radiological outcome representative revealed there was a statistically significant change in the intercoccygeal angle between traumatic and non- traumatic. It's also worth noting that lumbar spine diseases may be a risk factor. [5, 7, 14, 22] Finally, even though there is a widely held assumption that depression, neurosis, or hysteria can exacerbate the clinical signs of coccygodynia, [5, 6] no papers contained any information about the patients' psychological status.

It is stated clearly in seven studies [14–16, 18, 24, 25, 32] that Key's surgical procedures was performed, when compared with Garden's exposure results[11] that was used in Bayne et al.[5] study: Statistical examination of the incidence of problems in patients who have received the Gardner approach demonstrated a tendency toward a greater complication rate[10 (20.8%)] of 48 patients) than with Key's operation [30 (12.9%) of 232 patients] ($\chi 2=2.028$, df =1, p=0.154; 95% CI of the difference, −2.4 to 21.8%), nonetheless, this change was not statistically significant. Numerous publications discussed the advantages of total coccygectomy over partial coccygectomy, which present to be linked with a higher rate of recurring pain and revision surgery. [19, 23, 46] According to some experts, sup-periosteal resection produces superior outcomes and reduces the danger of infection when compared to total coccygectomy. [12, 21]Any disease affecting the lower spine or rectal area must be documented and evaluated carefully. [47] Syndromes of Canal Alcock's and descending perineum) [48–50] by doing a rectal examination in conjunction with a sigmoidoscopy.

More than eighty-two of patients reported satisfaction with the methods efficacy, and their satisfaction with the results. However, certain authors documented that post trauma or delivery patients with undiagnosed pathologies had a better prognosis with unidentified aetiology,[5, 21] Wray and Templeton[51] male patients with trauma or idiopathic aetiology, as well as those who did not

success at trial of conservative therapy, had a higher failure rate. Finally, the total complication rate was 11.3%, although none were life-threatening. Most cases had infections that were successfully treated with antibiotics or surgical treatments. However, some complications previously described as prolapsus of the rectum and rectal injuries during coccygectomy,[52] In this systematic study, we were unable to confirm them. Furthermore, we were unable to show a causal link between infection and a negative result.

By the analysis of the demographics of the conservative intervention's patients, complete information was absent. Only two research showed data on body mass index (BMI). [33, 39] They revealed that high BMI is correlated with coccydynia. Furthermore, none of the studies contained information on the individuals' co-morbidities, such as diabetes, which may have an influence on the healing process. [53] Including more particular demographic information about patients would assist physicians in determining if these therapies are suitable for their patients. Coccydynia has been observed to occur five times more frequently in females than in males., [2] This ratio, however, was absent from the papers we examined. Due to the significant number of males involved in this research, the results may have limited generalizability to a mostly female population.

Three of the publications evaluated in this study included manual treatment as part of their coccydynia treatments. Khatri et al. [39] intrarectal manipulation was shown to be beneficial in the treatment of coccydynia idiopathic (GRADE: Moderate, weak references for usage). However, they did not exercise enough control over analgesic use throughout their procedures, which calls into question the legitimacy of their findings. Wuet al. [36] utilize diathermy in conjunction with manual therapy to treat coccydynia in the subacute and chronic phases (GRADE: low, weak recommended usage). Due to the absence of a control group and the association of management strategies in this research, the effectiveness of manual treatment alone for coccydynia cannot be determined. Each research evaluated manual therapy differently, restricting our ability to compare outcomes. Two researchers manipulated the coccyx in the sagittal plane [33, 36] while another chose to twist coronally. [39]

Three trials examined the efficacy of injections in treating coccydynia. Mitra et al. [34] failed to achieve statistically meaningful outcomes in their research of injection of steroids to treat coccydynia (GRADE: Very Low, weak approval against usage). Due to statistical insignificance, the insufficient sample size, and the short duration of follow-up, this article was reduced to a weak recommendation against usage. Khan et al. [35] Dextrose prolotherapy was investigated and presented to be beneficial in individuals with idiopathic coccydynia when home regimens failed (GRADE: low, weak recommended usage). This research established a significant therapeutic impact (mean VAS enhanced from 8.5 to 2.5). Datir and Connell [38] demonstrated that chemical ganglion neurolysis impar improved pain in chronic coccydynia (GRADE: very low, weak approval for usage). Due to lack of standardization of therapies among patients and a limited sample size, the evidence was downgraded. The aetiology and length of onset of symptoms to be critical factors in identifying the most optimal injection for coccydynia therapy.

Three studies investigated the use of(ESWT): 70%reported good to excellent satisfaction, [40] After 6 months of follow-up, 90.2% Successful (VAS <4), (41)At the conclusion of the study, the median numerical pain scale fell significantly from 7.0 ± 4.0 to 2.0 ± 2.0, and the median Oswestry disability score enhanced from 24.0± 9.0 to 8.0± 9.0. ($p<0.001$). [42]

Another treatment option is radiofrequency thermocoagulation. for coccydynia. Demircay et al. [37] employed RFT of the ganglion impar and had significant alleviation of pain for an average of 9.1 ±

1.2 months between pre- and post-management VNS tests. (GRADE: very low, with very restricted use recommended).

5. Conclusion

This systematic review and meta-analysis may add to the body of information regarding coccydynia therapy choices. According to the thirty-one publications evaluated, there are a variety of conservative therapies that may be beneficial in lowering coccydynia-related pain, but further study is needed. Coccygectomy looks to be a viable surgical option for individuals who do not improve with conservative therapy. Key's most common surgical approach, total sub-periosteal coccygeal excision, produces superior outcomes and has fewer problems. The individual must be advised that subsequent coccygectomy, wound infection may arise because of bacterial colonization, causing the lesion to heal more slowly. This problem, however, is not typically connected with a bad result.

Limitations of the study

The authors encountered many constraints when conducting the systematic review:

1. Coccydynia is a specialized subject of study because of the absence of accessible research and the low quality of proof in published studies.

2. To enroll as many patients as feasible, a qualitative assessment of the research result determined that it may be essential to reduce the specificity measurements of finding.

3. There is a wide variation in the quality of information amongst qualifying research, of which only few may be included in the study.

Reference

1. Simpson JY. Coccygodynia and diseases and deformities of the coccyx. Med Times Gaz. 1859;40:1–7. [Google Scholar]

2. Maigne JY, Doursounian L, Chatellier G. Causes and mechanisms of common coccygodynia: role of body mass index and coccygeal trauma. Spine (Phila Pa 1976) 2000;25(23):3072–3079. [PubMed] [Google Scholar]

3. Duncan GA. A painful coccyx. Arc Surg. 1937;34:1088–1104. [Google Scholar]

4. Wray CC, Easom S, et al. Aetiology and treatment. J Bone Joint Surg Br. 1991;73(2):335-338. [PuMed] [Google Scholar]

5. Bayne O, Bateman JE, Cameron HU. The influence of etiology on the results of coccygectomy. ClinOrthopRelatRes. 1984;190:266–272. [PubMed] [Google Scholar]

6. Pyper JB. Excision of the coccyx for coccygodynia; a study of the results in twenty-eight cases. J Bone Joint Surg Br. 1957;39 B(4):733–737. [PubMed] [Google Scholar]

7. Postacchini F, Massobrio M. Idiopathic coccygodynia. J Bone Joint Surg Am. 1983;65:123–126. [Google Scholar]

8. Maigne JY, Tamalet B. Standardized radiologic protocol for the study of common coccygodynia and characteristics of the lesions observed in the sitting position. Clinical elements differentiating luxation, hypermobility, and normal mobility. Spine (Phila Pa 1976) 1996;21(22):2588–2593. [PubMed] [Google Scholar]

9. Maigne JY, Guedj S, Straus C. Idiopathic coccygodynia. Lateral roentgenograms in the sitting position and coccygeal discography. Spine (Phila Pa 1976) 1994;19(8):930–934. [PubMed] [Google Scholar].

10. Key JA. Operative treatment of coccygodynia. J Bone Joint Surg Am. 1937;19:759–764. [Google Scholar]

11. Gardner RC. An improved technique of coccygectomy. ClinOrthop. 1972;85:143–145. doi: 10.1097/00003086-197206000-00025. [PubMed] [CrossRef] [Google Scholar]

12. Bilgic S, Kurklu M, Yurttaş Y, et al. Coccygectomy with or without periosteal resection. IntOrthop. 2010;34(4):537–541. doi: 10.1007/s00264-009-0805-2. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

13. Maigne JY, Lagauche D, Doursounian L. Instability of the coccyx in coccygodynia. J Bone Joint Surg Br. 2000;82(7):1038–1041. doi: 10.1302/0301-620X.82B7.10596. [PubMed] [CrossRef] [Google Scholar]

14. Perkins R, Schofferman J, Reynolds J. Coccygectomy for severe refractory sacrococcygeal joint pain. J Spinal Disord Tech. 2003;16(1):100–103. doi: 10.1097/00024720-200302000-00016. [PubMed] [CrossRef] [Google Scholar]

15. Ramsey ML, Toohey JS, Neidre A, et al. Coccygodynia: treatment. Orthopedics. 2003;26(4):403–405. [PubMed] [Google Scholar]

16. Doursounian L, Maigne JY, Faure F, et al. Coccygectomy for instability of the coccyx. IntOrthop. 2004;28(3):176–179. 10.1007/s00264-004-0544-3. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

17. Hodges SD, Eck JC, Humphreys SC. A treatment and outcomes analysis of patients with coccydynia. Spine J. 2004;4(2):138–140. doi: 10.1016/j.spinee.2003.07.011. [PubMed] [CrossRef] [Google Scholar]

18. Wood KB, Mehbod AA. Operative treatment for coccygodynia. J Spinal Disord Tech. 2004;17(6):511–515. doi: 10.1097/01.bsd.0000128691.36652.16. [PubMed] [CrossRef] [Google Scholar]

19. Karalezli K, Iltar S, Irgit K, et al. Coccygectomy in the treatment of coccygodynia. ActaOrthop Belg. 2004;70(6):583–585. [PubMed] [Google Scholar]

20. Feldbrin Z, Singer M, Keynan O, et al. Coccygectomy for intractable coccygodynia. Isr Med Assoc J. 2005;7(3):160–162. [PubMed] [Google Scholar]

21. Pennekamp PH, Kraft CN, Stütz A, et al. Coccygectomy for coccygodynia: does pathogenesis matter? J Trauma. 2005;59(6):1414–1419. doi: 10.1097/01.ta.0000195878.50928.3c. [PubMed] [CrossRef] [Google Scholar]

22. Balain B, Eisenstein SM, Alo GO, et al. Coccygectomy for coccygodynia: case series and review of literature. Spine (Phila Pa 1976) 2006;31(13):E414–E420. [PubMed] [Google Scholar]

23. Mouhsine E, Garofalo R, Chevalley F, et al. Post-traumatic coccygeal instability. Spine J. 2006;6(5):544–549. doi: 10.1016/j.spinee.2005.12.004. [PubMed] [CrossRef] [Google Scholar]

24. Capar B, Akpinar N, , et al. Coccygectomy in patients with coccygodynia. ActaOrthopTraumatolTurc. 2007;41(4):277–280. [PubMed] [Google Scholar]

25. Sehirlioglu A, Ozturk C, , et al. Coccygectomy in the surgical treatment of traumatic coccygodynia. Injury. 2007;38(2):182–187. doi: 10.1016/j.injury.2006.09.013. [PubMed] [CrossRef] [Google Scholar]

26. Cebesoy O, Guclu B, , et al. Coccygectomy for coccygodynia: do we really have to wait? Injury. 2007;38(10):1183–1188. doi: 10.1016/j.injury.2007.01.022. [PubMed] [CrossRef] [Google Scholar]

27. Traub S, Glaser J, Manino B. Coccygectomy for the treatment of therapy-resistant coccygodynia. J SurgOrthop Adv. 2009;18(3):147–149. [PubMed] [Google Scholar]

28. Trollegaard A, Aarby N, Hellberg S. Coccygectomy: an effective treatment option for chronic coccydynia.J Bone Joint Surg [Br] 2010; 92-B: 242-5.

29. KerrE, daniel B. and rudolphJ.Coccygectomy for chronic refractory coccygodynia: clinical case series and literature review.JNeurosurg Spine. 2011; 14:654–663,.

30. Haddad B, Prasad V, Khan W, Alam M, Tucker S.Favourable outcomes of coccygectomy for refractory coccygodynia.Ann R CollSurgEngl 2014; 96: 136–139 doi 10.1308/003588414X1381402167667 5.

31. Hanley N,Ode G , Jackson B. Coccygectomy for patients with chronic coccydynia.Bone Joint J2016; 98-B: 526–33.

32. HochgattererR.GahleitnerM. Allerstorf erJet al. Coccygectomy for coccygodynia: a cohort study with a long-termfollow-up of up to 29 years.European Spine Journal (2021) 30:1072–1076 https://doi.org/10.1007/s00586-020-06627-w

33. Maigne J, ChatellierG, Le Faou M, Archambeau M. The treatment of chronic coccydynia with intrarectal manipulation: a randomized controlled study. Spine 2006;31:E621–7.

34. Mitra R, Cheung L, Perry P. Efficacy of fluoroscopically guided steroid injections in the management of coccydynia. Pain Physician 2007;10:775–8.

35. Khan SA, Kumar A, Varshney MK, Trikha V, Yadav CS. Dextrose prolotherapy for recalcitrant coccygodynia. J OrthopSurg (Hong Kong) 2008;16:27–9.

36. Wu C, Yu K, Chuang H, Huang M, Chen T, Chen C. The application of infrared thermography in the assessment of patients with coccygodynia before and after manual therapy combined with diathermy. J Manipulative PhysiolTher. 2009;32:287–93.

37. Demircay E, Kabatas S, Cansever T, Yilmaz C, Tuncay C, Altinors N. Radiofrequency thermocoagulation of ganglion impar in the management of coccydynia: preliminary results. Turk Neurosurg. 2010;20:328–33.

38. Datir A, Connell D. CT-guided injection for ganglion imparblockade: a radiological approach to the management of coccydynia. ClinRadiol. 2010;65:21–5.

39. Khatri SM, Nitsure P, Jatti RS. Effectiveness of coccygeal manipulation in coccydynia: a randomized control trial. Indian J PhysiotherOccupTher. 2011;5:110–2.

40. Lin SF, Chen YJ, Tu HP, Lee CL, Hsieh CL, Wu WL, et al. The effects of extracorporeal shock wave therapy in patients with coccydynia: a randomized controlled trial. PLoS One. 2015;10(11):e0142475.

41. Adas, C., Ozdemir, U., Toman, H., Luleci, N., Luleci, E., &Adas, H. (2016). Transsacrococcygeal approach to ganglion impar: radiofrequency application for the treatment of chronic intractable coccydynia. Journal of pain research, 9,1173.

42. Marwan Y, Dahrab B, Esmaeel A, Ibrahim SA, Al-Failakawi J. Extracorporeal shock wave therapy for the treatment of coccydynia: a series of 23 cases. Eur J OrthopSurgTraumatol. 2017;27:591–8.

43. Fogel GR, Cunningham PY, 3rd, Esses SI. Coccygodynia: evaluation and management. J Am AcadOrthop Surg. 2004;12(1):49–54. [PubMed] [Google Scholar]

44. Fairbank JCT, Couper J, Davies JB, et al. The Oswestry low back pain questionnaire. Physiotherapy. 1980;66:271–273. [PubMed] [Google Scholar]

45. Kim NH, Suk KS. Clinical and radiological differences between traumatic and idiopathic coccygodynia. Yonsei Med J. 1999;49:215–220. [PubMed] [Google Scholar]

46. Hellberg S, Strange-Vognsen HH. Coccygodynia treated by resection of the coccyx. ActaOrthop Scand. 1990;61(5):463–465. doi: 10.3109/17453679008993564. [PubMed] [CrossRef] [Google Scholar]

47. Grassi R, Lombardi G, Reginelli A, et al. Coccygeal movement: assessment with dynamic MRI. Eur J Radiol. 2007;61(3):473–479. doi: 10.1016/j.ejrad.2006.07.029. [PubMed] [CrossRef] [Google Scholar]

48. Mazza L, Formento E, Fonda G. Anorectal and perineal pain: new pathophysiological hypothesis. Tech Coloproctol. 2004;8(2):77–83. doi: 10.1007/s10151-004-0060-x. [PubMed] [CrossRef] [Google Scholar]

49. Parks AG, Porter NH, Hardcastle J. The syndrome of the descending perineum. Proc R Soc Med. 1966;59(6):477–482. [PMC free article] [PubMed] [Google Scholar]

50. Sinaki M, Merritt JL, Stillwell GK. Tension myalgia of the pelvic floor. Mayo Clin Proc. 1977;52(11):717–722. [PubMed] [Google Scholar]

51. Wray AR, Templeton J. Coccygectomy. A review of thirty-seven cases. Ulster Med J. 1982;51(2):121–124. [PMC free article] [PubMed] [Google Scholar]

52. García FJ, Franco JD, Márquez R, et al. Posterior hernia of the rectum after coccygectomy. Eur J Surg. 1998;164(10):793–794. doi: 10.1080/110241598750005462. [PubMed] [CrossRef] [Google Scholar]

53. Claes L, Recknagel S, Ignatius A. Fracture healing under healthy and inflammatory conditions. Nat Rev Rheumatol. 2012;8:133–43.