Acute traumatic instability of the coccyx: results in 28 consecutive coccygectomies

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Abstract

Introduction Coccygeal instability includes hypermobility, subluxation and fracture-dislocation. Surgical resection is still controversial, with intractable post-traumatic coccygodynia being an indication to surgery.

Materials and methods From 2001 to 2010, we enrolled 31 patients with post-traumatic coccygodynia (19 females, 12 males; mean age 31 years, range 21–47). Conservative treatment failed in 28 patients, who underwent surgical resection of the coccyx. Twenty-one were total, while seven were partial coccygectomies. At follow-up (mean 33 months; range 24–70), clinical outcomes evaluation included measurement of complications rate, pain relief and satisfaction degree.

Results Nineteen patients experienced complete pain relief, while two had incomplete, and four had no relief. Partial coccygectomies were associated with poor results. Twenty-one patients were satisfied, whilst four were not.

Conclusions Coccygectomy is the treatment of choice for post-traumatic instability. Patients' selection allowed excellent or good results. This study favors a more

aggressive approach including total resection of the coccyx.

Keywords Coccygeal trauma · Instability of the coccyx · Coccygodynia · Coccygectomy

Introduction

Pain affecting coccyx is referred to as coccygodynia [1], and it may be due to different causes. Women between 30 and 40 years of age are mostly affected, with a female to male ratio of 4:1 [2]. Sitting position, defecation and sexual activities may exaggerate pain.

Direct axial trauma may determine mechanical coccygodynia, due to subluxation, dislocation or hypermobility [3, 4]. Pain is usually harsh and may limit daily activities, whereas it is responsive to bed rest and conservative treatment [5].

Non-responder individuals with chronic coccygodynia (about 20–30 % of overall patients), may benefit from surgical coccyx excision. Several authors [2, 6–8] report good results after coccygectomy in patients with post-traumatic or idiopathic coccygodynia. Patient selection by means of radiographical and psychological assessment may help in optimizing results [9].

In 1937, Key first described a surgical procedure, which included removal of the mobile, fractured portion of the coccyx [10]. Nevertheless, many surgeons prefer Gardner's technique [11], and no general consensus is given on treatment options. Another issue takes into account the extent of the excision, with many authors reporting similar results with total and partial coccygectomy [7, 9, 12], whereas others [3, 13] claim total coccyx resection to be the best surgical choice.

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In this study, we report our series of 28 consecutive coccygectomies (19 total resections, 7 partial resections) due to fracture-dislocation and drug-resistant post-traumatic coccygodynia. End-points in this study included complications, residual pain and satisfaction rate.

Materials and methods

From January 2001 to December 2010, we observed 53 consecutive patients affected by acute coccygodynia, with pain duration of less than 30 days [9]. Of these patients, 31 individuals had clearly sustained direct trauma. Nineteen females and 12 males were included in this series, with a mean age of 31 (range 21–47). In two patients, a stable thoraco-lumbar fracture was associated. All patients were studied by standard, two views radiograms, and underwent 2–3 months of conservative treatment, including physical therapy, sitting aids, and rest. Twenty-eight of these patients had no or poor improvement after nonsurgical treatment, and therefore surgery was indicated. A VAS pain assessment was performed, with seven patients reporting a ten points VAS pain, whilst remaining 21 showed scores ranging from 5 to 9 (mean 6.8 ± 2.0 SD). Sitting radiograms, according to Maigne [4, 9], helped identifying 18 type I anterior instabilities (60 %) and 13 type II posterior instabilities (40 %). According to Postacchini and Massobrio classification [12], most individuals showed a type III coccyx, whereas four patients had a type II and two patients had type I.

Surgical procedure

Dietary restrictions were followed 3–5 days before surgery and patients undergoing surgery had a pre-operative enema. While giving anaesthesia, 2 g Cephazoline were administered. Patients were prone-positioned with flexed hip and buttocks slightly spread open by means of plaster aid, with the aim of stretching skin on the intergluteal line. Adhesive sterile drapes were placed on site after skin disinfection. We performed coccygectomy following Key's technique [10], as thoroughly described by Bilgic et al. [14] in their Group 1 patients. We never used sub-periosteal technique [14]. Unstable, mobile fragment was excised en-bloc via a trans-discal approach, including its periosteum. We performed a total of 21 total coccygectomies with three fragments removal (Fig. 1a–d), while seven partial coccygectomies were performed resecting two bony fragments (Fig. 2a–d). Discectomy was always performed in a radical way, and when protrusion of the sacrum or of the first coccygeal vertebra occurred, a rongeur was used for bone contouring. Resection was confirmed by radiograms taken at the end of the surgery. Anatomical sample was cleaned

and pictures were taken. An accurate hemostasis and several washings with saline and Gentamycine were carried out, and wound closure was performed in a three-layer fashion [3]. If torn, pre-sacral fascia was carefully closed with resorbable sutures. No resorbable skin sutures and/or drainage were used. Surgery duration was always less than 80 min (mean 65; range 50–80). Therefore, no supplemental antibiotics were administered.

Post-operative follow-up

Patients were discharged 1 day after surgery, with clean wound dressing and after administration of a second dose of 2 g Cephazoline. Further antibiotic administration by Levofloxacin was continued for 5 days and a low-fiber, high starch content diet was started, with the aim of prevent defecation for the first 5 post-operative days. Wound cleaning was carried out every 3 days and a sitting aid was used if needed.

Clinical results were recorded at follow-up and included a VAS score and satisfaction assessment. We compared total to partial coccygectomies with a Chi-squared test with a *p* value significance set at <0.05 (IC = 95 %).

Outcome

No hematomas or infections were found at the follow-up. Sutures were removed after 12–15 post-operative days. With a mean follow-up of 33 months (range 24–70) on 25 patients (3 patients lost), no or moderate pain was found (VAS 0–1; mean 0.3 ± 1.0 SD; $p = 0.013$) in 19 patients (75 %), and no pain was reported during defecation. Six patients (25 %) had residual coccygodynia, with two of them experiencing mild pain whilst four had severe pain (VAS 4–8; mean 6.1 ± 0.8 SD; $p = 0.021$). All patients with severe coccygodynia (67 %) had undergone partial coccygectomy but refused second surgery for total resection. Twenty-one patients out of 25 (85 %) were satisfied with their result, whereas remaining four individuals (25 %) were totally unsatisfied (Table 1).

Discussion

Pain in the most caudal segment of the spine is referred to as coccygodynia, and it increases after prolonged direct pressure, like when sitting on hard surfaces. It causes about 2,000 hospitalizations every year, both in the U.S. and in the U.K. [15, 16]. Factors determining coccygodynia may differ significantly [17], and psychological profile should be taken into account. Very common causes include either direct trauma or repeated micro-trauma [18]. Coccygeal hypermobility and instability may cause sacro-coccygeal

Fig. 1 **a** Preoperative X-ray in standing position. Coccygeal fracture-dislocation Maigne type I (Postacchini type III); **b** preoperative MRI shows the severe anterior luxation and complete instability of the coccyx; **c** specimen after total coccygectomy (3 fragments); **d** intraoperative X-ray confirms total resection

and/or intercoccygeal inflammation [19]. Coccygeal and/or pelvic tilting [12], together with obesity [2], may promote the aforementioned changes.

Several studies report case series with mixed etiology [12, 20], most commonly post-traumatic and idiopathic, while pure post-traumatic series are quite uncommon [3, 7]. Our study only considered post-traumatic patients, with coccygeal fractures-dislocations due to direct trauma. Preoperative tests, including MRI and dynamic radiograms [9], showed an increase of the sacro-coccygeal angle of more than 25°. Our series therefore consisted in post-traumatic coccygeal lesions, with true instability. Pain during defecation was the most annoying symptom. This may be due to hypermobility of the fractured coccyx [21], detected most often in severe instability with anterior

dislocations. All but three of them showed resistance to conservative treatment.

MRI has recently shown to be indicated when radiograms fail in making diagnosis [22], while CT helped clarifying morphology and morphometry of the adult coccyx [23]. In our experience, neuroimaging can help measuring the distance between the anteriorly dislocated coccygeal tip and pre-rectal fascia and this factor may be helpful in planning surgery.

A number of conservative options and algorithms have been suggested in order to address coccygodynia [5]. Acute, post-traumatic coccygodynia, however, may last more than 2 months and then turn into chronic coccygodynia [10, 18, 24]. When chronic pain occurs, which happens in about 20–30 % cases [7], surgical resection

Fig. 2 **a** Preoperative CT shows coccygeal posterior dislocation Maigne type II, with sacrococcygeal fusion; **b** line of surgical resection to achieve bone beveling of the first coccygeal vertebra; **c** specimen after partial coccygectomy; **d** intraoperative control

should be indicated [25]. Theoretically, coccyx may be resected en-bloc or even partially without any major complications, whereas literature lacks these information [23]. In 1726, Petit, cited by Powers [24], is thought to be the first having performed coccygectomy. The technique, however, was thoroughly described by Key [10]. Powers [24] and Gardner [11] techniques are thought to be less safe than Key's procedure in that they include a retrograde caudo-cranial dissection starting from coccygeal tip. A recent review by Karadimas et al. [2] shows that Gardner technique had a significant increase in complications when compared to Key's procedure, which provides a safe

anterograde, cranio-caudal dissection starting from sacro-coccygeal or intercoccygeal joints down to the tip. Finger insertion into the anus, in order to facilitate tip resection while protecting rectum, is no longer used due to increased contamination rate [17]. We perform tip resection by gentle dissection via a bony way, according to Key's technique. Separation of the pre-rectal fascia is facilitated by pre-operative evaluation of its thickness. Discectomy is always radical and performed by cauterization.

We are not experienced with a recently introduced subperiosteal technique [14], which anyway may be of interest, since it was published by the end of our study.

Table 1 Summary of data and final results in 21 total and 7 partial coccygectomies

Coccygectomy	Total	Partial	Significance
Cases	21	7	
Age	29 (23–41)	27 (21–47)	No
Sex	13 F; 8 M (21 cases)	4 F; 3 M (7 cases)	No
Length pain before	70 days (63–84)	76 days (60–86)	No
Etiology	Direct trauma	Direct trauma	
Follow-up time	32 months (24–60)	35 months (28–70)	No
Pts lost	2	1	
VAS before	6.7 ± 1.5 (7–10)	6.3 ± 1 (5–9)	No
VAS after	1.8 ± 2 (0–4)	4.6 ± 3.3 (0–8)	0.013
Satisfaction			
Poor	0	4	0.027
Good	8	1	0.048
Excellent	11	1	0.034
Infection	0	0	

Success rate in coccygectomy range from 100 to 54 % [17]. Our success rate averages 75 %, which is consistent with literature [3, 25]. Poorest results were associated with partial coccygectomies, when only intercoccygeal unstable portion was excised. In other terms, more than a half of intercoccygeal resections were affected by residual pain and overall unsatisfactory results. Intercoccygeal resections were performed when sacrococcygeal joint was considered to be partially fused or apparently normal. Sehrioglu et al. [3] reported similar results: 3 patients had residual coccygeal pain after partial resection. All three patients had good results after re-operation to a proximal segment excision. Unfortunately, our three unsatisfied patients refused a second surgery.

We conclude that total coccygectomy seems to be better than partial procedure, the latter to be reserved only for selected cases. Therefore, we perform complete resection when a sacrococcygeal instability is found, whereas patients with intercoccygeal instability associated with total sacrococcygeal fusion undergo partial excision. When excessive bony protrusion is seen, due to bulky first coccygeal vertebra, bone beveling is performed. Finally, when an intercoccygeal instability is found in association with a normal or partially fused sacrococcygeal joint, total coccygectomy is preferred. This may seem to be in contrast to some authors' conclusions [12] who stand for partial coccygectomy regardless the coccyx type. We believe that good results reported by those authors may be due to the high rate of sacrococcygeal fusions (more than 50 % of their surgical case series). We agree that partial

coccygectomy should be the treatment of choice in this subpopulation.

The most common complication is infection, either deep or superficial. It is generally produced by *S. aureus* [8]. Surgical site infections are facilitated by poor antibiotic prophylaxis or surgical technique. A sub-periosteal technique has been recently introduced [14] with the aim of lower infections rate, but it needs wider studies to be statistically validated. Antibiotic protocols may vary widely [3, 8, 13, 14, 20] and either single shot therapy [8] or prolonged administration within 3–5 post-operative days have been suggested [3, 20]. Patient himself may favour contamination by poor self care [14]. In this study we used 2 g IV Cephazoline at time 0 and after 24 h. After patient discharge, 1 g oral Levofloxacin per day for 5 post-operative days was administered. Wound care was strictly maintained by office cleaning every 3 days until sutures removal. With this protocol, no infections were seen in this study.

Conclusions

Coccygectomy is effective in most post-traumatic coccygodinias, especially when associated with fracture-dislocation and radiographic instability. It may be partial or total, with no major clinical differences. Nevertheless, this study seems to show an increased failure rate associated with partial coccygectomies. We therefore perform partial excisions only when pre-operative neuroimaging shows complete sacro-coccygeal fusion. Post-operative antibiotic prophylaxis for 5 days, together with serial wound control until sutures removal, seem to prevent the most important complication, which is considered to be infection.

Conflict of interest None.

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