SPINE Volume 25, Number 23, pp 3072–3079

Causes and Mechanisms of Common Coccydynia

Role of Body Mass Index and Coccygeal Trauma

Jean-Yves Maigne, MD,* Levon Doursounian, MD,† and Gilles Chatellier, MD‡

Study Design. A total of 208 consecutive coccydynia patients were examined with the same clinical and radiologic protocol.

Objectives. To study radiographic coccygeal lesions in the sitting position, to elucidate the influence of body mass index on the different lesions, and to establish the effect of coccygeal trauma.

Summary of Background Data. A protocol comparing standing radiographs and radiographs subsequently taken in the painful sitting position in coccydynia patients and in controls has shown two culprit lesions: posterior luxation and hypermobility. Obesity and a history of trauma have been identified as risk factors for luxation.

Methods. Dynamic radiographs were obtained. The body mass index was compared with the coccygeal angle of incidence, sagittal rotation of the pelvis when sitting down, and the presence and time of previous trauma. The patients with the newly described lesions were examined after an anesthetic block under fluoroscopic guidance.

Results. Two new coccygeal lesions are described (anterior luxation and spicules). Obesity was found to be a risk factor. The body mass index determines the way a subject sits down, and lesion patterns were different in obese, normal-weight, and thin patients (posterior luxation: 51%, 15.2%, 3.7%; hypermobility: 26.5%, 30.3%, 14.8%; spicules: 2%, 15.9%, 29.6%; normal: 16.3%, 32.6%, 48.1%, respectively; $P < 0.0001$). Trauma affected the type of lesion only if it was recent (<1 month before the onset of coccydynia), in which case the instability rate increased from 55.6% to 77.1%. Backward-moving coccyges were at greatest risk of trauma.

Conclusions. This protocol allows identification of the culprit lesion in 69.2% of cases. The body mass index determines the causative lesion, as does trauma sustained within the month preceding the onset of the pain. [Key words: body mass index, coccydynia, coccygodynia, instability, pilonidal sinus] **Spine 2000;25:3072–3079**

Common coccydynia is a painful condition that may be related to trauma or childbirth or that may occur without any identifiable cause.[1,11] Recently, a protocol for the examination of coccydynia patients has been described that involves a comparison of lateral radiographs taken in the standing and in the most painful sitting position. When this protocol was applied to a first series of 51 patients, two lesions were identified: posterior luxation of the coccyx and hypermobility.[5] Hypermobility was defined as coccygeal flexion >25° in the sitting position (mean value in healthy control subjects: 7.4° ± 5.7°). In a second study involving 91 new patients, the protocol was refined and standardized.[6] It was found that three clinical factors were more common in patients with posterior luxation than in the rest of the patient population: obesity, a history of trauma, and transient exacerbation of the pain when standing up from sitting.

The present study represents a continuation of previous research. It was undertaken to look for hitherto undescribed coccygeal lesions. An attempt was made to assess certain signs and symptoms of coccydynia. Also, the way patients sit down was studied in terms of angles measured on radiographs and compared with the different culprit lesions.

Materials and Methods

The study was performed in 208 consecutive patients who presented to this center with chronic coccydynia between 1996 and 1998. Coccydynia was defined as pain in or around the coccyx, without any significant radiation or associated low back pain, with triggering or worsening of the pain when sitting (or, more rarely, on passing from the sitting to the standing position). Coccydynia was regarded as chronic when the condition had persisted for 2 months. The patients came from various places nationwide; most of them had been referred to this center by their physicians.

In every case, the following details were recorded: gender, age, body mass index (BMI), pain (transiently exacerbated or triggered) on passing from the sitting to the standing position, history of precipitating trauma (fall or childbirth), noting the time of the traumatic event in relation to the actual onset of the patient's chronic coccydynia, and type of seat (hard or soft) reported to make the pain worse. Each patient was examined with lateral dynamic radiographs used to measure the following angles: angle of mobility, coccygeal angle of incidence, and angle of sagittal pelvic rotation (Figure 1).

Lateral Dynamic Radiographs. The first radiograph was a standing film taken after 10 minutes' standing. For the second radiograph, the patient was requested to sit in what he or she considered to be the most painful position. This involved gradually leaning backwards from an upright position, until the familiar pain could be felt, and then keeping the pelvis still in this painful position. The two radiographs thus obtained were superimposed over a bright light source to allow measurement of the relative movements of the sacrum and the coccyx.

The angle of mobility was used as a measure of the sagittal rotation movement of the coccyx when sitting down into the painful position. This movement may be forward (flexion) or backwards (extension).

From the *Department of Physical Medicine, Hotel-Dieu University Hospital, the †Department of Orthopaedic Surgery, Boucicaut Hospital, and the ‡Department of Medical Statistics, Broussais Hospital, Paris, France.
Device status category: 1.
Conflict of interest category: 12.

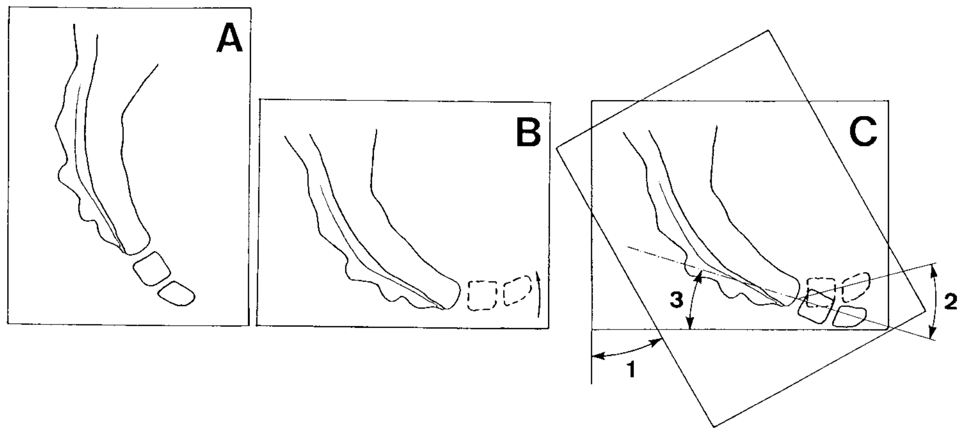

Figure 1. Measurement of angles. **A,** Standing radiograph. **B,** Sitting radiograph, showing flexion of the coccyx (dotted line). **C,** Superposition of the two radiographs matching the sacrum, obtained by pivoting the sitting film through an angle representing sagittal pelvic rotation (Angle 1 = angle of rotation). Coccygeal mobility is indicated by Angle 2 (angle of mobility). Angle 3 is the angle at which the coccyx strikes the seat surface (angle of incidence).

In an earlier study, the intraobserver and interobserver variations in the measurement of this angle were found to be 15.3% and 12.5%, respectively; accuracy was ± 2.6°, and normal values ranged from no movement (immobile coccyx) to 20° ± 2.5° of movement.[5] Hypermobility in flexion was defined as an angle of mobility >25°. In some cases, it was found that the coccyx did not rotate in the sagittal plane, but luxated posteriorly or anteriorly, with loss of the normal anatomic relations. In such cases, the angle of mobility cannot be measured.

The coccygeal angle of incidence has been described before, under the name of base angle.[6] It is defined as the angle at which the coccyx strikes the seat when the subject is sitting down. The angle of incidence determines the direction of sagittal movement of the coccyx.[6] If the angle is low, the coccyx will be more or less parallel with the seat surface at the moment of contact. The pressure exerted by the seat on sitting down will result in flexion of the coccyx. If, conversely, the angle of incidence is large, the coccyx will be more or less oblique or perpendicular to the seat surface at the moment of contact. The coccyx then will go into extension. This movement into extension probably is related to the increased intrapelvic pressure (pushing the coccyx backwards), which is, in turn, related to the pressure exerted by the seat.

The angle of sagittal pelvic rotation, which has not been described previously, was used to measure the sagittal rotation of the sacrum, and, thus, of the pelvis (not considering sacroiliac rotation) when the subject is sitting down into the reference position, defined as the sitting position in which the familiar pain is felt. Once this position had been clearly established, the patient was asked to stop further pelvic movement. In this way, the sitting position of coccydynia patients could be standardized.

Patients with previously undescribed coccygeal lesions were examined after an anesthetic block under fluoroscopic control (intralesional or perilesional injection of 0.5–1 mL lidocaine 2%), to test whether the coccydynia was caused by the lesion observed. The test was considered positive if the injection provided >75% pain relief (measured with a visual analog scale).

For purposes of the study, the patients were subdivided into three groups according to the direction of their coccygeal movement: group 1 (forward movement: anterior luxation; hypermobility, which is always in flexion; normal mobility in flexion); group 2 (backward movement: posterior luxation, normal mobility in extension); and group 3 (immobile, or with movement < 5°).

Statistical Analysis

Proportions were compared using the χ^2 test. Comparisons of several means were performed using ANOVA or *t* tests, as appropriate. Statistical significance was defined as $P < 0.05$. Data are presented as means (± 1 SD).

Results

Description of Lesions Observed

A radiologic lesion responsible for the coccydynia was found in 144 patients (69.2%) (Table 1). Posterior luxation and hypermobility (Figures 2 and 3) have been described before.[5] In addition to these lesions, anterior luxation was seen in some coccyges. The luxations and hypermobility were globally termed instability. A morphologic abnormality in the form of a small bony excrescence on the dorsal aspect of the tip of the coccyx was also found. This feature was termed a spicule.

Table 1. Features of the Different Lesions Observed

	Posterior Luxation	Anterior Luxation	Hypermobility	Spicule	Normal Coccyx
n = 208	46 (22.1%)	11 (5.3%)	57 (27.4%)	30 (14.4%)	64 (30.8%)
Age (yrs) *P* = 0.06	46.4 ± 10.6	41 ± 13.8	47.2 ± 13.6	39.6 ± 16.3	42.7 ± 15.6
Pelvic rotation	29.8 ± 11.4°*	43.1 ± 18.9°	42.2 ± 12.8°	41.5 ± 14.7°	40.6 ± 15.1°
Coccygeal incidence	45.7 ± 22.2°*	−3.7 ± 27.1°	16.4 ± 18.2°	17.1 ± 27.6°	14.4 ± 18.6°

* $P < 0.0001$.

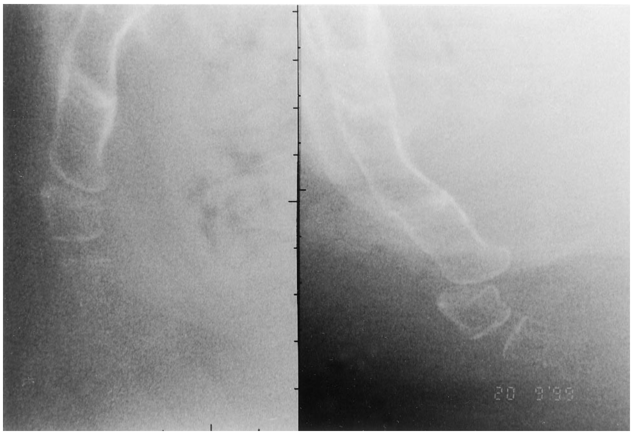

Figure 2. Posterior luxation in the sitting position.

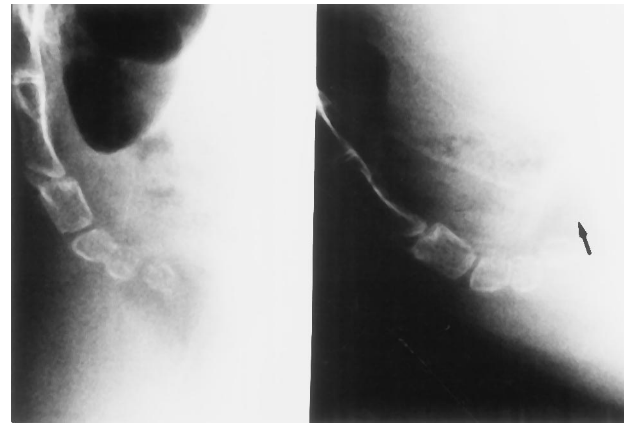

Figure 4. Anterior luxation. This rare lesion always involves the most distal portion of the coccyx.

Anterior luxation was a rare lesion (5.3%). It always involved the most distal portion of the coccyx, which would luxate forwards (Figure 4). It tended to occur in the more sharply angled coccygeal patterns (Types III and IV of Postacchini and Massobrio,[7] whereas posterior luxation was more common in the straighter (Type I) pattern. A coccygeal spicule (Figures 5 and 6) was seen in 30 patients (14.4%). Spicules were found 22 times on immobile coccyges. Where there was a spicule, it could always be readily palpated, jutting out under the skin; it would cause irritation on sitting. In 25 of the 30 patients, there was a pit of greater or lesser depth in the skin overlying the spicule or a little higher in the natal cleft. Although this pit was usually fairly discreet, there were three cases of frank retrococcygeal pilonidal sinus; none of these had a discharge or abscess. The pit was considered to be evidence of the embryonic origin of the malformation (Figure 7). With both anterior luxation and spicules, the anesthetic block test was invariably positive, showing that the lesions were giving rise to the coccydynia. Coccydynia from anterior luxation or from spicules was seen to occur in leaner (Table 2, $P < 0.0001$) and slightly younger patients ($P = 0.06$).

Sixty-four patients (30.8%) had no radiologic abnormalities other than occasional nonspecific osteophytes or evidence of osteoarthrosis, which were not considered to be relevant lesions because they were not exacerbated on sitting. Of these 64 patients, 43 had forward movement of the coccyx, four had backward movement, whereas 17 had an immobile coccyx.

Pelvic Sagittal Rotation, Coccygeal Angle of Incidence, and Direction of Coccygeal Movement

Table 3 shows the three coccygeal movement groups: group 2 (backward moving; n = 50) differed significantly ($P < 0.0001$) from group 1 (forward-moving; n = 119) and group 3 (immobile; n = 39). The direction of coccygeal movement was strongly influenced by the amount of pelvic sagittal rotation and by the angle of incidence ($P < 0.0001$). The patients with pronounced pelvic rotation (mean: >40°) had a small angle of incidence (mean: <

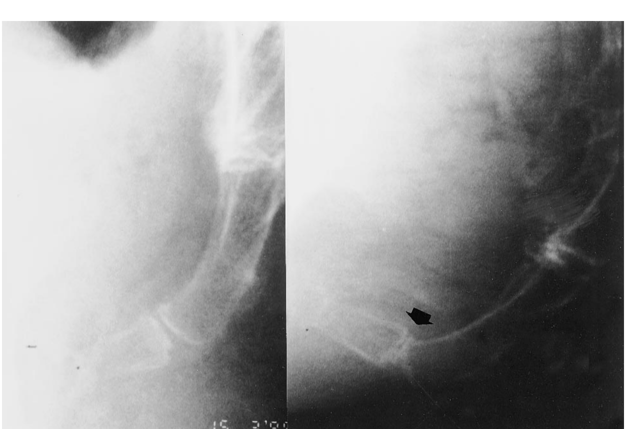

Figure 3. Hypermobility in flexion. Friction between joint surfaces in the sitting position.

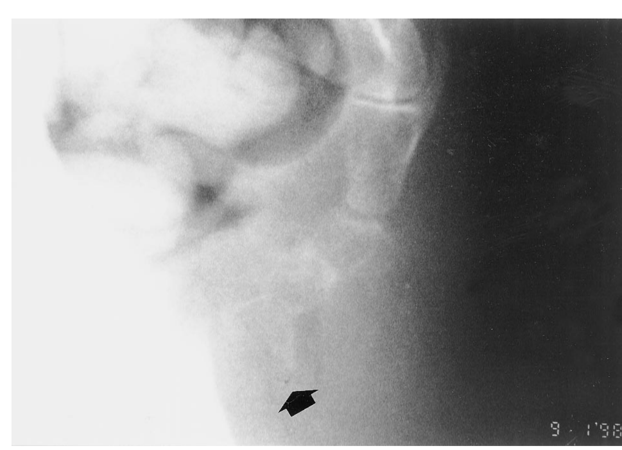

Figure 5. Coccygeal spicule on the dorsal aspect of the tip of the coccyx. It is difficult to detect, even on good-quality radiographs, which explains why it has not been described earlier.

Figure 6. Three-dimensional reconstruction of a coccygeal spicule.

Figure 7. Skin pit and coccygeal spicule forming a "mirror-image" pattern. With hips flexed in the fetal position, the two lesions match; with hips extended, the pit is at a slightly higher level.

20°) and forward-moving or immobile coccyges, whereas those with a lesser degree of pelvic rotation (mean: <30°) had a pronounced angle of incidence (mean: 48.2°) and backward-moving coccyges. A more detailed analysis by type of lesion (rather than by direction of coccygeal movement) showed posterior luxations to be significantly associated with a small angle of pelvic rotation and a large angle of incidence (ANOVA; P = 0.0001). Also, posterior luxations differed very significantly from anterior luxations in terms of angle of pelvic rotation and of angle of incidence ($P < 0.0001$; Table 1).

Influence of Body Mass Index (BMI)

Obesity is defined as a BMI >27.4 in women and >29.4 in men. Using this definition, 7% of the population in France is obese.[3] In the present series, 49 patients (23.5%) were obese; this rate was 3.4 times the national average ($P < 0.0001$).

The coccyges moving backward were associated with the highest BMI values, whereas the forward-moving and the immobile coccyges were associated with normal or low BMI values (Table 3; $P < 0.0001$). Regression analysis showed the BMI to vary inversely with pelvic rotation and directly with the angle of incidence (P = 0.02 and $P < 0.0001$, respectively). In other words, the higher a patient's BMI, the less his or her pelvis will rotate, and the steeper the angle between the coccyx and the seat will be on sitting down. Conversely, the lower the patient's BMI, the more the pelvis will rotate, and the shallower the angle of incidence will be. The BMI also was found to be associated with the type of lesion. A breakdown by gender showed this relation to be more marked in women, where the association between the BMI and the type of lesion was significant ($P < 0.0001$). In the male patients in this study (15.9% of the study population), the same pattern was observed, albeit to a lesser degree, which was not statistically significant (P = 0.52; Table 2). Thus, the coccygeal lesion patterns observed in obese, normal-weight, and thin patients were significantly different (χ^2 test [8*df*] = 43.7; $P < 0.0001$; Table 4).

Pain on Standing Up From Sitting

As will be seen from Table 5, patients who reported pain that was made worse on passing from the sitting to the standing position had a very significantly ($P < 0.0001$) higher rate of coccygeal radiologic abnormalities of all

Table 2. Body Mass Index as a Function of the Type of Lesion

n = 208		Posterior Luxation	Anterior Luxation	Hypermobility	Spicule	Normal Coccyx
175 women	n (%)	36 (20.6%)	11 (6.3%)	53 (30.3%)	25 (14.3%)	50 (28.6%)
	BMI	28.8 ± 4.5	21.6 ± 2.6	24.2 ± 4.2	21.8 ± 3.1	22.2 ± 3.2
33 men	n (%)	10 (30.3%)	0 (0.0%)	4 (12.1%)	5 (15.1%)	14 (42.4%)
	BMI	28.1 ± 4.4	—	27.1 ± 6.3	25.5 ± 3.6	26.1 ± 1.7

BMI = body mass index.

Table 3. Body Mass Index, Pelvic Rotation, and Coccygeal Incidence as a Function of the Direction of Coccygeal Movement on Sitting Down

	Group 1 Forward-Moving	Group 2 Backward-Moving	Group 3 Immobile
n = 208	119	50	39
BMI	23.5 ± 3.8	28.3 ± 4.9	23.4 ± 3.1
Pelvic rotation	42.6 ± 13.2°	28.9 ± 11.6°	40.0 ± 17.9°
Coccygeal incidence	12.0 ± 17.2°	48.2 ± 21.8°	16.9 ± 27.3°

Analysis of variance; $P < 0.0001$.
BMI = body mass index.

kinds (instability or spicules) than did patients whose pain was not made worse on standing up from sitting. The sensitivity of this sign was 79.8%; however, its specificity was poor (47.2%). Its positive and negative predictive values were 66.6% and 63.1%, respectively.

History of Trauma

One hundred and thirty patients gave a history of trauma directly involving the coccyx in the more or less distant past; in some cases, the traumatic event had occurred 20 years earlier. In 14 cases, the pain had started in the immediate postpartum period. Overall, there were 144 cases (69.2%) of posttraumatic coccydynia. Of these, 80 (55.6%) had coccygeal instability. Of the 64 patients who had no history of trauma, 34 (53%) had coccygeal instability. This means that the proportion of patients with instability was the same in the subgroups with and without a history of trauma (χ^2 test [1 *df*] = 0.10; P = 0.74). Thus, a history of trauma that does not take account of the time between the traumatic event and the onset of chronic coccydynia does not have a discernible effect on the causative lesion. If one considers the time to onset, however, the percentage of instabilities increases markedly. Where the traumatic event was less than a month previously, the instability rate was found to be 77.1% (χ^2 test [4*df*] = 36.5; $P < 0.0001$; Table 6). It follows that only coccydynia starting within a month from an accident or from childbirth should be considered as genuinely traumatic in origin. It is in this sense that the term traumatic coccydynia is used below.

As will be seen from Table 7, 50% of the coccydynia cases with backward-moving coccyges were traumatic in origin; in the other groups (forward-moving, and immobile), the rate was 28% (45/158). Traumatic coccydynia patients had a steeper angle of incidence (P = 0.05). Luxation was the lesion most often seen after trauma, with more than one in two patients with a history of trauma showing this instability (Table 8). Conversely, spicules were seen to be very rarely trauma-related. Of the coccydynia cases in the obese patients, 44.9% were traumatic in origin, as opposed to 28.3% of the coccydynia cases in normal-weight or thin patients (χ^2 test (1 *df*) = 4.7; P = 0.02).

Hard or Soft Seat

The obese patients, men, and patients with posterior luxations were slightly more affected by sitting on hard seats; however, this difference was not significant (P = 0.1, P = 0.2, and P = 0.15, respectively).

Discussion

This series of 208 coccydynia patients is larger than any previously reported to date. It sheds new light on the causes and mechanisms of common coccydynia.

Radiologic Lesions

In this study, two new causes of coccydynia involving the distal coccyx were identified: coccygeal spicules and anterior luxation. Spicules, which cause irritation when the subject is sitting, are most commonly seen in immobile coccyges, in which the pressure from the spicule is made worse by the inability of the coccyx to take evasive action. Stern[9] suggested chronic bursitis in an adventitial bursa as a cause of coccydynia in patients with coccyges "pointed downward instead of anteriorly," a pattern that appears to resemble what the authors of the present study have termed a spicule. Spicules are implicated in the causation of coccydynia based on the following evidence: 1) spontaneous, nontrauma-related onset of the coccydynia, as commonly seen in inflammatory lesions; 2) pain experienced at the tip of the coccyx (unlike the pattern seen with the other coccygeal lesions, where the pain is greatest at the level of the joint involved) and elicited very precisely by pressure on the spicule (which is always readily palpable under the skin); 3) visualization of the bony excrescence with imaging techniques; and 4) pain relief after local anesthesia. It also should be noted that in more than 80% of these patients, there was a pit in the overlying skin or even a frank pilonidal sinus (not infected or suppurating), which provides evidence of the dysembryonic origin of the lesion. Also, the spicules were symptomatic only in the leaner patients, in whom lack of subcutaneous fat is probably a risk factor. Thus, apart from cases of infected pilonidal sinus, what has been

Table 4. Frequency of the Different Lesions as a Function of the Patients' Body Mass Index

	Posterior Luxation	Anterior Luxation	Hypermobility	Spicule	Normal Coccyx
Obese patients BMI > 27.4 (n = 49)	25 (51%)	2 (4%)	13 (26.5%)	1 (2%)	8 (16.3%)
Normal-weight patients 19.5 < BMI < 27.4 (n = 132)	20 (15.2%)	8 (6.1%)	40 (30.3%)	21 (15.9%)	43 (32.6%)
Thin patients BMI < 19.5 (n = 27)	1 (3.7%)	1 (3.7%)	4 (14.8%)	8 (29.6%)	13 (48.1%)

Chi-square test (8 *df*) = 43.7; $P < 0.0001$.
BMI = body mass index.

Table 5. Frequency of Radiographic Lesions as a Function of the Presence or Absence of Pain on Passing From the Sitting to the Standing Position

	Presence of Radiographic Lesion n = 144	Absence of Radiographic Lesion n = 64	Total n = 208
Presence of pain on standing up from sitting	96 (66.6%)	23 (36.9%)	119
Absence of pain on standing up from sitting	48 (33.4%)	41 (63.1%)	89

$P < 0.0001$.

described in the literature as pain from a pilonidal sinus may, in fact, be coccydynia related to a "mirror-image" malformation of the coccyx underneath a soft tissue pit or sinus, first describe here.[8] Suppuration should be ruled out before steroid treatment of a spicule associated with a pilonidal sinus.

Anterior luxation is rare. Like spicules, the condition involves the distal portion of the coccyx and requires meticulous radiographic technique for detection; it also occurs in the leaner patients. The role of both spicules and anterior luxation as culprit lesions in coccydynia was shown in the present study with anesthetic blocks. Improved visualization of spicules may be obtained with MR imaging.

The actual implication of the lesions described here in the causation of coccydynia may, of course, be doubted. It might be argued that in low back pain patients, lumbar lesions frequently are found coincidentally that are not related to the pain. The authors of the present study do not think that this argument applies to the radiologic protocol described here, which, apart from spicules, shows lesions that are present only in the painful sitting position. In an earlier study, these lesions did not exist in the matched controls.[5] There may be asymptomatic mild (<35°) hypermobility in women with very lax joints; also, some cases of painless spicules associated with a pilonidal sinus in patients with low back pain have been observed. In doubtful cases, the chief diagnostic criterion is an anesthetic block. Psychological factors need also to be considered. Experience shows that they could play a role in coccydynia patients with a normal coccyx or borderline hypermobility.

Angles

The interobserver and intraobserver variations and the accuracy of the measuring technique were determined (for the angle of mobility only) in a previous study.[5] Because the method of measuring the other angles is similar, it was thought that similar precision and accuracy could be expected.

Pelvic rotation in the sitting position was determined by the appearance of the familiar pain, with instructions to the patient to keep his or her pelvis still as soon as the pain appeared. This rotation corresponds to the situation where the coccyx is maximally stressed. It cannot be measured in a subject without pain in the coccyx, therefore, because there is no standardized sitting position. It is unknown whether conclusions about the association between BMI and pelvic rotation can be translated to subjects without coccydynia. It would appear logical to assume, however, that the greater pelvic volume of the obese reduces the mobility of the pelvis and affects the usual sitting pattern of the obese subject.

Body Mass Index and Coccydynia

One important finding in the present study was the demonstration of the way in which the BMI affects the frequency and causes of common coccydynia. Obesity is a risk factor for coccydynia in the general population for posterior luxation and for trauma. Conversely, the normal-weight patients had mainly hypermobility or radiographically normal coccyges. Coccygeal spicules and anterior luxation were seen in the patients with the lowest BMI.

These findings suggest the following explanation. The greater the BMI, the less the pelvis will rotate sagittally, and the steeper the angle of incidence will be. In other words, the coccyx of an obese patient will jut out more posteriorly when he or she is sitting down. As a result, it will be more exposed to the sudden increase in intrapelvic pressure that occurs in a fall, as well as in repeated sitting down, because obese subjects tend to let themselves drop onto a seat with insufficient pelvic rotation. This increased exposure to pressure increases will, in turn, put the coccyx at greater risk for luxation, which is the typical posttraumatic lesion (the obese subject's way of sitting down being a mechanism of microtrauma in its own right). These findings are in line with those of another recent study, in which it was found that patients

Table 6. Frequency of Coccygeal Instability as a Function of Time Between Traumatic Event (Accident or Childbirth) and Onset of Coccydynia

	Trauma 12 to 6 Months Earlier	Trauma 6 to 3 Months Earlier	Trauma 3 Months to 1 Month Earlier	Trauma Less Than 1 Month Earlier	Total
Instability	2 (29%)	6 (46%)	5 (16%)	54 (77.1%)	67 (56%)
No instability	5 (71%)	7 (54%)	27 (84%)	16 (32.9%)	55 (44%)

Chi-square test (4 *df*) = 36.5; $P < 0.0001$.

Table 7. Comparison of Traumatic *versus* Nontraumatic Coccygodynia

	Angles		Direction of Coccygeal Movement		
	Pelvic Rotation	Coccygeal Incidence*	Forwards n = 119	Immobile n = 39	Backwards n = 50
Traumatic (n = 70)	38.2 ± 15.4°	26.5° (−35° to 85°)	36 (51.4%)	9 (12.8%)	25 (35.7%)
Nontraumatic (n = 138)	40.1 ± 14.0°	16° (−45° to 85°)	83 (60.1%)	30 (21.7%)	25 (18.1%)
P	0.23	0.05		0.024	

* Median value. Mann–Whitney test.

with traumatic coccydynia had straighter coccyges than did patients with nontraumatic coccydynia.[2] Unlike the obese, lean subjects will strongly rotate the pelvis when sitting down. This rotation tucks the coccyx into the pelvis, where it will be reasonably well protected against injury. The lean subject's coccyx will hit the seat in a mechanically optimal way, at a shallow angle that permits physiologic flexion and allows the coccyx to absorb shocks and cope with the pressure of the seat. As a result, lean subjects have a greater rate of coccydynia from hypermobility (an excessive form of physiologic flexion), from spicules (where the pain is not trauma-related but inflammatory in origin), or of coccydynia without any radiologic abnormalities. These last-mentioned cases of coccydynia of unknown origin present the greatest management challenge.

Trauma and Coccydynia

The relation between trauma caused by outside forces and coccydynia has been known for a very long time.[10] Patients may blame an injury sustained several years previously, or even in childhood, whereas their coccydynia is only of a few months' duration. The present study shows that only injuries sustained within the month before the onset of coccydynia will significantly increase the risk of instability (especially of posterior luxation), and that only this recent trauma has an established effect in terms of precipitating coccydynia. The same time limit applies to childbirth. If more than a month has elapsed since the traumatic event, the percentage of patients with instability will not differ significantly from that in patients without a history of trauma. This is an important point to bear in mind in medicolegal contexts.

Coccygeal biomechanics also must be taken into account. A fall on the buttocks involves the same pelvic movement pattern as does sitting down. Backward-moving coccyges will be more exposed and be at greater risk for posterior luxation. Consequently, obesity and traumatisms lead to the same coccygeal lesions. Because the movement patterns are identical, obesity and trauma will lead to the same coccygeal lesions being produced.

Type of Seat

It was not determined why some patients should feel pain only when sitting on hard or soft seats. There would appear to be other factors of sacrococcygeal dynamics that have not, as yet, been identified. As a general rule, car seats cause problems because of vibrations, which may be very poorly tolerated by coccydynia patients.

■ Conclusions

In the examination of a patient with chronic coccydynia, three clinical parameters are of major importance: the BMI, the time since any trauma in the patient's history was sustained in relation to the onset of the chronic coccydynia, and the presence of pain on standing up from the sitting position. The only diagnostic information to be obtained by clinical examination is palpation evidence of a spicule at the tip of the coccyx, with the familiar pain produced by pressure on the structure. Provided that the sitting radiograph is taken in the position in which the familiar pain occurs and that the tip of the coccyx is properly seen on the radiograph, the protocol described here allows a culprit lesion to be found in nearly 70% of cases of chronic coccydynia. The high detection rate is beneficial, because it should allow a large number of patients to be correctly diagnosed. It should also make it possible to study different treatment-

Table 8. Frequency of Causative Trauma in the Different Radiographic Lesions

	Posterior Luxation, n = 46	Anterior Luxation, n = 11	Hypermobility, n = 57	Spicule, n = 30	Normal Movement of Immobile Coccyx, n = 64
Traumatic (n = 70)	25 (54.3%)	6 (54.5%)	23 (40.3%)	3 (10.0%)	13 (20.3%)
Nontraumatic (n = 138)	21 (45.7%)	5 (45.6%)	34 (59.7%)	27 (90.0%)	51 (79.7%)

Chi-square test (4 *df*) = 24.7; $P < 0.0001$.

methods in different lesion/coccygeal movement groups in future randomized controlled trials.[4]

Key Points

- In patients with chronic coccydynia, a comparison of standing *versus* sitting radiographs will show a causative lesion in 70% of cases; this lesion is related to the mobility of the coccyx.
- The comparison of standing *versus* sitting radiographs allows the measurement of sagittal rotation of the pelvis (pelvic tilt) and of the coccygeal angle of incidence, which are characteristic features of the subject's way of sitting down.
- These angles are related to the subject's BMI and determine the type of coccygeal lesion. Thus, the BMI has a major influence on the causative lesion.
- Only trauma sustained within 1 month before the onset of coccydynia affects the type of causative lesion.

References

1. Howorth B. The painful coccyx. Clin Orthop 1959;14:145–61.
2. Kim NH, Suk KS, Lee HM. Comparison between idiopathic and traumatic coccygodynia. International Society for the Study of the Lumbar Spine Meeting, Hawaii, USA, 1999.
3. Laurier D, Guiguet M, Chau NP, et al. Prevalence of obesity: A comparative study in France, the United Kingdom, and the United States. Int J Obes Relat Metab Disord 1992;16:565–72.
4. Maigne JY, Doursounian L, Lagauche D. Instability of the coccyx in coccydynia. J Bone Joint Surg [Br] 2000; 82:1038–41.
5. Maigne JY, Guedj S, Straus C. Idiopathic coccygodynia. Lateral roentgenograms in the sitting position and coccygeal discography. Spine 1994;19:930–4.
6. Maigne JY, Tamalet, B. Standardized radiologic protocol for the study of common coccygodynia and characteristics of the lesions observed in the sitting position. Spine 1996;21:2588–93.
7. Postacchini F, Massobrio M. Idiopathic coccygodynia: Analysis of fifty-one operative cases and a radiographic study of the normal coccyx. J Bone Joint Surg [Am] 1983;65:1116–24.
8. Sondenaa K, Andersen E, Nesvik I, et al. Patient characteristics and symptoms in chronic pilonidal sinus disease. Int J Colorect Dis 1995;10:39–42.
9. Stern FH. Coccygodynia among the geriatric population. J Am Geriatr Soc 1967;15:100–2.
10. Sugar O. Coccyx. The bone named for a bird. Spine 1995;20:379–83.
11. Wray CC, Easom S, Hoskinson J. Coccydynia. Etiology and treatment. J Bone Joint Surg [Br] 1991;73:335–8.

Address reprint requests to

Jean-Yves Maigne, MD
Department of Physical Medicine
Hotel-Dieu University Hospital
Place du Parvis de Notre-Dame
F-75004 Paris
France
E-mail: jy.maigne@htd.ap-hop-paris.fr