TRAUMATIC LUXATION OF THE COCCYX[1]

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THE patient whose case introduces this paper, a Mr. E. H., white, aged 55, married, a foundry worker, weight 150 pounds, sustained an injury to the coccyx on May 25, 1929. In the course of his duties, he fell from a step-ladder, landing on his buttocks on a wooden box, a corner of which directly struck the coccyx. He experienced immediate pain and was referred to the company physician, who found, the following morning, by rectal examination, an unevenness of the anterior surface of the coccyx, and pain upon pressure, both externally and in the rectum. He diagnosed a dislocation and referred the patient to me for roentgen examination. Lateral projection revealed a forward luxation of the first coccygeal segment, which was displaced a distance almost equal to its own thickness, the rest of the coccyx being symmetrically curved. The outlines of the upper coccygeal and the last sacral element indicated that no bony fusion had existed and the remaining segments showed distinct spacing, as if separated by cartilage. The antero-posterior view gave no hint of the luxation, but showed a vertical line in the first segment that was suspicious of fracture, without displacement. The cornua were not visible; the transverse processes were very rudimentary. Four coccygeal segments were plainly registered, the distal one possibly representing a fusion of two rudimentary elements. The contour of the sacrum and coccyx described a normal curvature, except for the luxated first segment, and there was no lateral deviation.

On May 27 the attending physician reduced the dislocation, by intrarectal digital pressure, with the patient in a kneeling position. Bowel movements were painful for only a few days, but for three or four weeks the patient complained of an aching sensation. He resumed work in eight weeks.

On October 5 he was referred for another roentgen examination, at which time he said he was free from all pain and ache, except after long automobile rides. Digital examination was painless. The roentgen films showed the same luxation of the first segment, with apparent callus formation anteriorly at the sacrococcygeal junction.

Medical literature shows few and brief allusions to roentgen examination of the coccyx. Careful search failed to reveal any article in roentgenologic journals, and the text-books give little or no information. George and Leonard (1), in their recent volume, illustrate a case of anterior luxation. Jones and Lovett (2) say: "X-ray may or may not be reliable in this region and the antero-posterior view shows only lateral displacement. To obtain satisfactory definition in a side X-ray is, of course, difficult, but often possible with a highly perfected technic." Letters written to 94 roentgenologists brought few helpful replies.

Coccyx (plural *coccyges*) is a word derived from the Greek, meaning a "cuckoo," probably because of a fancied resemblance to a cuckoo's beak. The German equivalent is "Steissbein" and the French is identical with the English. Colloquially, it is called the "tail bone" or "crupper bone." It is a small bone of variable length, forming the caudal extremity of the spine, but destitute of a canal. It comprises four or five segments (rarely three or six), of which the first is the largest and shows some rudiments of the structure of a sacral segment, while the others dwindle into successively smaller

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[2]Dr. Oakman died before proof of this paper could be submitted to him, so that it is unknown what changes he might have made.

and characterless nubbins of bone (vertebræ caudales). Piersol (3) says that data concerning ossification are very unsatisfactory. Each segment has one center, the first may have two; ossification begins in the first piece near birth, and successively later in the others, up to puberty. The first segment presents two cornua, projecting up posteriorly behind the posterior surface of the sacrum; it also presents two rudimentary transverse processes. Both the cornua and the processes are variable, sometimes being well-formed and either rugged or slender, and sometimes being hardly more than tubercles. The first segment is somewhat wedge-shaped, and has greater breadth than length or thickness; it is sometimes asymmetrical. The entire coccyx is usually more rugged in the male than in the female.

The apices of the sacrum and of the first coccygeal element are connected by fibrocartilage, and a few unimportant ligaments. This synchrondrosis sometimes shows osseous fusion, and the distal segments also may fuse. Gray (4) says that the last three segments are usually fused with one another, and the last may be bifid; complete ankylosis is likely to result in fracture in the event of trauma. Bony fusion occurs oftener in the male, and usually at an earlier period.

Variations from the normal curve of the coccyx are common; lateral deviations are very frequent, but apparently never productive of symptoms; exaggerated forward curve is frequent and occasionally impinges on the rectum and produces trouble; the rarer posterior curving may project beneath the skin and induce pressure changes. Absence of the coccyx has been reported (5). One hears occasionally of human beings with a coccyx developed into a true tail, but no authentic report is discoverable in medical literature.

Muscles are attached as follows, according to Buchanan (6): The gluteus maximus to the back of the upper three segments, close to the lateral border; the sphincter ani externus to the tip; posterior fibers of the levator ani and a portion of the coccygeus to the lateral borders.

The junction of the sacrum and coccyx completes the fifth posterior sacral foramen for transmission of the posterior division of the fifth sacral nerve. No nerves emerge from the coccyx below this. The coccygeal plexus is composed of the fourth and fifth sacral nerves (except the visceral branch of the fourth anterior sacral), the coccygeus (anterior and posterior branches), and probably the inferior hemorrhoidal branch of the internal pubic. On the anterior aspect of the coccyx are two ganglia (Luschka's gland), belonging to the pelvic sympathetic system. These ganglia are united to each other by a small filament and are connected by other filaments to the last sacral ganglion of the chain forming the pelvic sympathetic (Hamant and Pigache, 7). Jointly these nerves supply sensation to the integument over the coccyx, around the anus, and the intervening area, and innervate the levator ani, sphincter ani, and coccygeus muscles.

The subject of dislocation of the coccyx has had much discussion in the past. Stimson (8) says that descriptions given by earlier writers were questioned in the early part of the twentieth century, and quotes Boyer as maintaining that the lesion never occurred; the matter was somewhat connected with coccygodynia, as cause and effect, but the actual occurrence of dislocation was well enough attested by several reports, mentioned by Stimson (Malgaigne, Roeser (9), Bonnafont (10), Mouret, 11), and also reports by Skene (12), Cyriax (13), Jones (14), Gehrung (15), Drueck (16), Petit (17), and Hirst (18). Undoubtedly some of the cases reported as dislocation were really displacements due to fracture, and the converse may be true. Practically none of the reports include roentgen evidence, many

of them having been made prior to Roentgen's discovery, and subsequent writers largely ignore its application in lesions of the coccyx. An article by Cyriax (13), in 1922, covers the clinical diagnosis, but does not allude to the X-ray. Several of the roentgenologists with whom the writer has corresponded stressed the point that X-ray examination is unnecessary, because the diagnosis by clinical means is so simple.

Several writers mention that dislocation is commoner in women than in men, because the intersegmental cartilages persist longer and allow displacement instead of fracture, and because many of these displacements occur at parturition: Hirst (18) also attributes man's relative immunity in part to the higher position of the coccyx and the closer approximation of the ischia; he states that during labor there is backward stress on the coccyx, sometimes producing rupture of ligaments, dislocation, or fracture. If displacement occurs, it is posterior, whereas direct external violence produces anterior displacement. Speed (19) says, regarding birth trauma: "Whether there is a true fracture at the sacrococcygeal junction or a stretching of the ligaments which permits the displacement, it is not always possible to decide, even with the help of a roentgenogram." Jolly (20) reported a unique case of escape of the distal segment of the coccyx through the anus ten days after childbirth. Cyriax (13) refers to displacements of the coccyx on the sacrum (*i.e.*, at the sacrococcygeal joint) but has never seen one distal to this point; he says that minor displacements seldom occur after middle life, due to the fact that the sacrococcygeal joint has united, although Piersol (3) states that it is not uncommon for the first segment to remain separate, without fusion to the sacrum or to the second segment.

Outside of birth injury, there is very rarely a posterior luxation of the coccyx. Injuries by direct violence, producing fracture or luxation, practically always show anterior displacement. The usual causation is a fall or a kick. Displacement of the coccyx may or may not be accompanied by tilting, or rotation, or both. Cyriax (13) reports cases of luxation due to rheumatic fever, straining at stool, pelvic cellulitis, and sudden effort to prevent falling. He thinks some cases are perhaps due to over-use of the sitting position, by which the coccyx is gradually pushed forward. The chronic sitters were mentioned by Ramsbotham (21) in 1851, who said: "Ankylosis often occurs in women who have been accustomed to sit the principal part of the day, as is the case with milliners."

The symptoms of a recently luxated coccyx are: (1) Pain, aggravated by defecation, sitting, riding, coughing, walking, and coitus, often causing the victims to sit sidewise and to shift position constantly; (2) impairment of bladder function (Speed, 19); (3) constipation, usually due to postponement of stool. Further and diverse symptoms may develop after the lapse of time, which will be discussed under a later heading.

Physical signs of a recent case include: (1) Tenderness on pressure externally or by rectum; (2) ecchymosis or other signs of bruising, though Cotton (22) says that ecchymosis is rare; (3) deformity, which may or may not be visible, and is usually detectable by palpation, either externally or by rectum, or both; (4) mobility of the displaced coccyx.

It may be difficult to differentiate between a fracture of the coccyx and a dislocation. The literature gives scant discussion to this point, and there is reason to believe that errors have been made. The existence of crepitus is by no means universal in fracture cases; probably fracture affects the proximal segment far oftener than it does all the others. An ankylosed coccyx is much more likely to suffer fracture than a jointed one.

If a physician sees a case of injured

coccyx long after the accident, diagnosis may not be so easy, and he is apt to fall back on the convenient term "coccygodynia." This is the word that has been in turn respected and later condemned. In 1859 Sir J. Y. Simpson (23) published his article, describing the cases of persistent pain in the coccyx, and dignified the condition as a separate entity under the term "Coccyodynia," a word which "caught on" and had long years of popular use. His description has hardly been improved upon, since he had a good understanding of the various kinds of pathology that may underlie it. He discovered early reports of coccygeal injury, including those by Smetius, sixteenth century, and Van Meeren and Gahrliep in the seventeenth. Simpson did tenotomy for relief of his first cases, but later did resection. However, the credit for the first resection must be given to Nott (24), of New Orleans, whose report appeared in 1844, describing a case of "neuralgia" from caries. Prior to this, in 1841, Blundell (25) had suggested the operation. Simpson inspired Scanzoni (26) to devote twelve pages to the subject in his text-book, published in 1861, and laid the foundation for what amounted almost to a fad for coccygectomy. However, the pendulum swung after a few decades, when it was found that this procedure was not uniformly successful, and we find Beach (27), in 1899, saying that resection in chronic cases of pain is "an operation notably unsuccessful." In Cotton's work (22), 1924 edition, appears the statement: "Most of the cases, even when there is a history of some injury, are essentially localized symptoms of a psychosis, 'hysteric,' as we name these localized psychoses. In such cases operation will not help the patient and will only discredit the operator." Meanwhile, it has been shown by various writers—C. Beck and V. S. Cabot (28), Gant (29), Hirst (18), Werner (30), Smith (31), Tillaux (32), Whitead (33), Blount (34), Boland (35), Tédenat and Simesaël (36), and Dinnendahl (37)—that resection is justified in certain cases of injury, tuberculosis, caries, periostitis, etc. It is claimed that no weakness or perceptible defective function ensues after resection. The interest in coccygodynia and in operative relief was for a long time maintained chiefly by the gynecologists and proctologists, while the general surgeons eschewed it.

In 1914 Yeomans (38) reported a new method of treatment by injections of alcohol at the site of pain. An article had appeared on the same subject by de Vézian in 1907 (39). The successful use of the faradic current by Seeligmuller and Grafe was mentioned in the 1904 edition of von Bergmann's "Surgery."

Some of the gynecologists in the past have been inclined to ascribe coccygodynia in certain cases to metritis, salpingitis, prolapsus uteri, prostatic disease, hemorrhoids, fissure, rectal tumor, etc. Hamant and Pigache (7), 1914, in a critical study, deplored this inclination. Yeomans (40), 1919, classified some cases as "symptomatic," or referred pain, due to disease of the central nervous system, such as hysteria, neurasthenia, irritable spine, traumatic neuroses, tabes, toxemia, and "habit pain."

In passing, it should be mentioned that the original term "coccyodynia" gave way to "coccygodynia," which was substituted because it is etymologically more precise. Colloquially it is variously known as "neuralgia of the rectum," "rheumatism of the rectum," "elongated spinal column" (Drueck) (16).

It seems to be fairly well agreed that the most common cause of coccygodynia is injury, either recent or remote, severe or mild, single or repeated. Stimson (8) thinks that dislocation and fracture are commoner than the reports indicate. Cyriax (13) stresses minor displacements and the subsequent occurrence (in either major or minor degree) of synovitis in the sacrococcygeal joint, adhesions, periostitis, periarticular thickening,

and irritation of sensory nerves through disturbance of the coccygeal ganglion. Hirst (18) remarks that after injury the lesion has a poor chance to heal, because of stress in all the usual activities of life, especially defecation, sitting, and rising.

The case report at the beginning of the present article shows so well the value of precise knowledge, as furnished by roentgen examination, that it needs no argument to urge the more widespread use of this method. Clearly, the lateral view is required, and with modern refinements of technic it ought to be possible to obtain such views in all cases of suspected injury. It is true that the interpreter must guard against being deceived by the anatomical variations, but I have seen in the literature no mention of variation that simulates true luxation. The recorded variations include lateral deviations and increased angulation, either forward or backward. In antero-posterior projections centering over the pelvis, such as are taken for any bony pathology in this area, or for the lower part of the urinary tract, there is always an image of the coccyx. The variations in contour, length, number of segments, ossification, and deviation from the midline have been noted by every one, but it is well known that luxation practically never occurs laterally, so that error in that respect can hardly occur. A series of lateral projections on healthy subjects was recently made by the writer, and there was found to be great divergence in the degree of curvature, but nothing resembling a dislocation. These anomalous curvatures show an intact sacrococcygeal joint, and intact intersegmental joints, whereas a luxation will show an abrupt irregularity at some one of these joints in the lateral view. In films loaned by Dr. H. B. Podlasky the antero-posterior view showed an over-lapping of the first and second coccygeal segments that seemed quite positive evidence of dislocation. No lateral view was taken. It seems probable that dislocation may occur oftenest at the sacro-coccygeal joint, but no reliable data are available, because the exact point of dislocation is rarely mentioned in reports, or, if it is, the opinion is based on physical examination, and X-ray evidence is never quoted. Those injuries which, upon roentgen examination, show abrupt and pronounced angulation, sometimes as much as 90 degrees, but little or no slippage at the joint, are very puzzling, because some normal coccyges show similar angulation. Therefore it becomes difficult to say in any given case of injury whether the angulation is pathologic or not. It is well known that coccygodynia sometimes occurs without detectable signs of displacement, due to conditions such as arthritis, periostitis, necrosis, etc., and such conditions may affect a coccyx that is naturally angulated, especially after trauma. Dervieux and Bélot (41), in 1926, reporting a case of coccygeal injury, say that the roentgen reading of these cases must be guarded; but if lateral roentgen examination should be made routinely, and the data accumulated, it would undoubtedly result in a greater power of discrimination.

These cases of injury sometimes have an important bearing in industrial work, attention being called to this point in 1910 by Courtois-Suffit and Bourgeois (42). The value of roentgen evidence in compensation disputes or damage procedures is well known. Dr. Podlasky's case *(cit. supra)* was one of industrial accident and it led to a long period of suffering and finally to surgical resection.

In making film records of the coccyx, the presence of a distended bladder or of gas in the rectum usually impairs the detail of the antero-posterior view. Kaisin (43), however, recommended the injection of air into the rectum. The best films are usually obtained with the Potter-Bucky diaphragm, using a restricting cone, a fine focus tube, careful immobilization, especially for the lateral, and the maximum practical distance. In the resulting image by the antero-poste-

rior view, it is usually possible to note the number of coccygeal segments, though the lateral view may sometimes be necessary for a correct count. The antero-posterior view also shows the characteristic shape of the first segment, its transverse processes, and occasionally its cornua, and it registers all lateral deviations. If the curvature is excessive, the coccyx will appear foreshortened, the segments seeming to overlie each other, and only a lateral film will reveal them and their interspaces separately. The lateral view will sometimes register the coccygeal and sacral cornua. Fractures are most likely to occur in the first segment, and be visible in the antero-posterior view, because the line of fracture is most often vertical. In Butler's (44) case the fracture is visible in both views, but the displacement is visible only in the lateral. Luxation may readily escape detection in the frontal projection. In the writer's case it is probable that the coccygeal cornua were broken off, allowing the forward slipping of the first segment.

In the course of correspondence with nearly a hundred roentgenologists on the subject of this article, replies were received from fifty-nine, and films or prints were loaned by eight. Fifteen others stated that they had seen cases, but for various reasons the film record was not available. Four mentioned that roentgen examination is unnecessary because the diagnosis is so easy by physical examination. I wish to take this opportunity of thanking all my colleagues who have answered my appeal, and especially those who sent roentgen records, including Dr. H. B. Podlasky, Dr. G. W. Grier, Dr. P. F. Butler, Dr. W. E. Chamberlain, Dr. P. M. Hickey, Dr. W. A. Evans, Dr. Lawrence Reynolds, Dr. H. A. Spilman, Dr. Samuel Brown, and Dr. T. A. Groover.

CONCLUSIONS

Little attention has been paid in the past to the roentgen examination of the coccyx. Lateral views are almost necessary in a film study of this area.

The normal coccyx has many variations of length, curvature, fusion, and bony markings, which may cause confusion in interpretation.

Complete and true dislocations, either of one segment or of the entire coccyx, can probably be easily detected on the films. Minor displacements may create doubt.

REFERENCES[3]

(IN TEXT)

(1) GEORGE, ARIAL W., and LEONARD, RALPH D.: The Vertebræ Roentgenologically Considered (Including a Study of Industrial Accident Cases). Vol. VIII of Annals of Roentgenology. Paul B. Hoeber, Inc., 1929.

(2) JONES, SIR ROBERT, and LOVETT, ROBERT W.: Orthopedic Surgery. William Wood and Co., 1924.

(3) PIERSOL, GEORGE A.: Human Anatomy. J. B. Lippincott Co., 7th Ed., 1919.

(4) GRAY, HENRY: Anatomy. 21st Ed., 1924, pp. 109 and 112.

(5) BLOOM, CHARLES J., STONE, RUSSELL E., and HENRIQUES, ADOLPH: Congenital Absence, Backward Deviation and Shortening of Coccyx. Arch. Ped., July, 1917, XXXIV, 514.

(6) BUCHANAN, ALEXANDER MAC G.: Manual of Anatomy: C. V. Mosby Co., 5th Ed., 1927.

(7) HAMANT and PIGACHE, R.: Étude critique sur la Coccygodynie. Rév. de Chir., 1914, XLIX, 70.

(8) STIMSON, LEWIS A.: Practical Treatise on Fractures and Dislocations. Lea and Febiger.

*(9) ROESER: Froriep's Notizen, 1857, II, 10. (Abstr. in For. Med. Chir. Rév., 1857, XX, 414).

(10) BONNAFONT: Deux observations de luxation du coccyx, suivies de quelques réflexions. L'Union Médicale, 1859, I, 136.

*(11) MOURET: Rec. de Mém. de Méd. Chir. et Pharm. militaires, 1859, I, 350.

(12) SKENE, ALEXANDER, J. C.: Treatise on the Diseases of Women. D. Appleton and Co., 1898, 172.

(13) CYRIAX, EDGAR F.: Minor Displacements of the Coccyx. Glasgow Med. Jour., August, 1922, XCVIII, 118.

*(14) JONES, G. W.: Effects of Dislocation of the Coccyx. Trans. Gynec. Soc., Boston, 1905, 152.

(15) GEHRUNG: Dislocation of Coccyx. St. Louis Cour. Med., 1888, XX, 544.

(16) DRUECK, CHARLES J.: The Coccyx: Malformations, Fractures, and Dislocations. Am. Jour. Clin. Med., February, 1924, XXXI, 99.

(17) PETIT, G. C.: Des accidents liés aux déplacements du coccyx consécutifs aux fractures et aux luxations anciennes de cet os. Thèse de Paris, 1900.

[3]The entries marked by an asterisk (*) cannot be verified, and it is impossible to say from what source Dr. Oakman drew the citations.

(18) HIRST, B. C.: Coccygodynia. University Med. Mag., Philadelphia, May, 1900, XIII, 153.
(19) SPEED, KELLOGG: A Text-book of Fractures and Dislocations. Lea and Febiger, 2nd Ed., 1928.
(20) JOLLY, W. J.: Fracture of the Coccyx and Passage of the Segment *per anum*. Med. Rec., Dec. 17, 1887, XXXII, 762.
(21) RAMSBOTHAM, FRANCIS H.: Principles and Practice of Obstetric Medicine and Surgery. 3rd Ed., London, 1851.
(22) COTTON, FREDERIC J.: Dislocations and Joint Fractures. W. B. Saunders Co., 2nd Ed., 1924, p. 145.
(23) SIMPSON, J. Y.: Coccyodynia and Diseases and Deformities of the Coccyx. Medical Times and Gazette, London, July 2, 1859, 1.
*(24) NOTT, J. C.: Extirpation of the Coccyx for Neuralgia. New Orleans Med. Jour., May, 1844.
(25) BLUNDELL, JAMES: Principles and Practice of Obstetric Medicine. Ed. revised by A. Cooper Lee and Nathaniel Rogers, London, 1840.
(26) v. SCANZONI, FRIEDRICH W.: Lehrbuch der Krankheiten der weiblichen Sexualorgane. Vienna, 1867.
(27) BEACH, H. H. A.: Compound Fracture of the Coccyx. Boston Med. and Surg. Jour., March 9, 1899, CXL, 234.
(28) BECK, C., and CABOT, V. S.: Partial Necrosis of Coccyx Due to Injury Two Years Prior to Operation. Surg. Clinics North Am., August, 1921, I, 1215.
(29) GANT, SAMUEL G.: Diseases of the Rectum, Anus, and Colon, Including the Ileocolic Angle, Appendix, Colon, Sigmoid Flexure, Rectum, Anus, Buttocks, and Sacrococcygeal Region. W. B. Saunders Co., Philadelphia, 1923, I, 159.
(30) WERNER, P.: Resection of the Coccyx during Childbirth. (In German.) Wien. klin. Wchnschr., May, 1923, XXXVI, 360.
(31) SMITH, E. NOBLE: Coccygodynia. Med. Press and Circular, London, Oct. 1, 1902, CXXV, 347.
(32) TILLAUX: Coccygodynie: Résection du Coccyx. Praticien, 1885, VIII, 293.
*(33) WHITEAD: Excision of the Coccyx. Lancet, July, 1887.
(34) BLOUNT, W. P.: Osteomyelitis of the Coccyx. Jour. Am. Med. Assn., Sept. 8, 1928, XCI, 727.
(35) BOLAND, F. K.: Osteitis of the Coccyx. Jour. Am. Med. Assn., June 11, 1927, LXXXVIII, 1883.
(36) TÉDENAT and SIMESAËL, ALBERT: Coccygodynie. Bull. de la Soc. d'Obst. et de Gynéc. de Par., 1925, XIV, 404.
*(37) DINNENDAHL: Thèse de Kiel, 1901.
(38) YEOMANS, F. C.: Coccygodynia: A New Method of Treatment by Injections of Alcohol. Proctologist, St. Louis, 1914, VIII, 211.
(39) DE VÉSIAN: Un cas rebelle de coccygodynie, traité et guéri par des injections d'alcool à 60°. Rév. Prat. de Gynéc., d'Obst. et de Pédiat., Par., 1907, II, 260.
(40) YEOMANS, FRANK C.: Coccygodynia: Further Experience with Injections of Alcohol in its Treatment. Surg., Gynec. and Obst., December, 1919, XXIX, 612.
(41) DERVIEUX, and BÉLOT: Lesion of the Coccyx From Falling Down Stairs. (In French.) Ann. de méd légale de Criminologie, 1926, VI, 545.
(42) COURTOIS-SUFFIT, and BOURGEOIS, FR.: Deux Cas de Coccygodynie d'Origine traumatique. Lancette Francaise Gaz. des hôpitaux, Dec. 13, 1910, LXXXIII, 1945.
*(43) KAISIN: Un perfectionnement technique dans l'examen roentgenographique de la région sacro-coccygienne. Jour. de Radiol., July 31, 1909, III.
(44) BUTLER, P. F.: Personal communication.

REFERENCES[8]

(NOT CITED IN TEXT)

1. BALDY, JOHN M.: An American Text-book of Gynecology, Medical and Surgical, for Practitioners and Students. W. B. Saunders Co., Philadelphia, 2nd Ed., 1898.
2. BALTHAZARD: Soc. de med. legale. January, 1911.
3. BLAND-SUTTON: Coccygodynia. Clin. Jour., London, Nov. 25, 1908, XXXIII, 97.
*4. CHARTIER: Coccygodynie. Rév. Neurologique, February, 1930, p. 20.
5. CIPRIANI, A. G.: Contribution to the Study of Coccygodynia. (In Italian.) Il Morgagni, Milan, 1899, XLI, 764.
6. CODET-BOISSE, and FEUTELAIS: Jour. de med. de Bordeaux, Jan. 29, 1911, XLI, 75.
7. DAVID, V. C.: Tuberculosis of Os Coccygis. Jour. Am. Med. Assn., Jan. 5, 1924, LXXXII, 21.
8. DRUECK, CHARLES J.: Coccygodynia. Jour. Indiana St. Med. Assn., July, 1926, XIX, 275.
9. GAUDIER, H., and BERTEIN, P.: L'ostéomyélite du Sacrum. Rév. de Chir., August, 1911, XLIV, 238.
10. GILLIAM, DAVID TOD: A Text-book of Practical Gynecology for Practitioners and Students. F. A. Davis Co., Philadelphia, 1907.
11. GOSSELIN: Lancette Francaise Gaz. des hôpitaux, 1861.
12. GRASHEY, RUDOLF: Atlas Typischer Röntgenbilder von Normalen Menschen; Ausgewählt und Erklärt nach Chirurgisch-praktischen Gesichtspunkten, mit Berüksichtigung der Varietäten und Fehlerquellen, Sowie der Aufnahmetechnik. J. F. Lehmann, Munich, 1923.
13. GRISEL, P.: L'Ostéomyélite du Sacrum. Rév. d'Orthopédie, 1912, XXIII, 313.
14. HECKSCHER, S.: Case of Ossification of the Coccyx Causing Dystocia. (In German.) Zentralbl. f. Gynäk., Nov. 10, 1928, LII, 2886.
15. JACKSON, J. N.: Fracture of Coccyx. Langsdale's Lancet, Kansas City, 1896, I, 299.
16. JORDAN, HARVEY E., and KINDRED, JAMES E.: A Text-book of Embryology. D. Appleton and Co., New York, 1926.
17. KEIBEL, FRANZ, and MALL, FRANKLIN: Manual of Human Embryology. J. B. Lippincott Co., Philadelphia, 1910-12, I, 355.
18. KÖHLER, ALBAN: Röntgenology. Turnbull's translation. Baillière, Tindall and Cox, London, 1928, p. 247.
19. LEWIN, PHILIP: The Coccyx, its Derangements and Their Treatment. Surg., Gynec. and Obst., November, 1927, XLV, 705.
20. LIELL, EDWARD N.: Excision of the Coccyx for Fracture and Necrosis, with a Report of Four Cases. Med. News, March 13, 1897, LXX, 332.
21. MARRO, ETIENNE: Essai sur la coccygodynie. Thèse de Paris, 1912.

22. MONNIER, L.: Ostéomyélite du Coccyx. Rev. d'Orthopédie, 1904, XV, 161.
23. MOWELL, JOHN W.: Fracture of the Sacrum and Coccyx. Internat. Clinics, 1921, II, 192 (Illustration of X-ray by Dr. Hollis Potter).
24. ODELL, W.: A Case of Removal of the Coccyx. Lancet, 1887, I, 1088.
25. PEISER, A.: Technic for Removal of Coccyx. Zentralbl. f. Chir., April 11, 1925, LII, 789.
*26. PERAIRE: Acad. de Med. de Paris, 1920.
*27. PHOCAS: Arch. prov. de chir., November, 1892.
28. POSSI, SAMUEL J., and JAYLE, F.: Traite de gynécologie clinique et opératoire. 1905-07, 4th Ed., Vol. II, p. 1326.
29. QUAIN: Elements of Anatomy. Longmans, Green and Co., 11th Ed., 1915, Vol. IV, pt. I, p. 25.
30. ROBERTS, JOHN B., and KELLY, JAMES A.: Treatise on Fractures. J. B. Lippincott Co., Philadelphia, 1916.
*31. ROCKWELL: Note on Three Cases of Traumatic Coccygodynia. Proc. Med. Soc. King's Co., Brooklyn, 1876, 239.
32. ROUVIÈRE, H.: Anatomie Humaine. Masson et Cie, 1924, I, 518.
33. SMITH, A. L.: Coccygodynia. Montreal Med. Jour., 1909, XXXVIII, 815.
34. SOBOTTA, JOHANNES, and MCMURRICH, J. PLAYFAIR: Atlas of Human Anatomy. G. E. Stechert and Co., New York, 1927, I, 8.
35. SPALTEHOLZ, WERNER: Hand Atlas of Human Anatomy. Transl. by Lewellys F. Barker. J. B. Lippincott Co., Philadelphia, 2nd Ed., I, 76.
36. STEINDLER, ARTHUR: Diseases and Deformities of the Spine and Thorax. C. V. Mosby Co., 1929.
37. TOLDT, CARL: An Atlas of Human Anatomy: For Students and Physicians. Rebman Co., New York, 1904, Pt. I, Sec. B.
38. WILSON, PHILIP D., and COCHRANE, WILLIAM A.: Fractures and Dislocations. J. B. Lippincott Co., Philadelphia, 1925, p. 446.
*39. WORMS, J.: Coccygodynie. Dictionnaire de Dechambre, 1876.

DISCUSSION

DR. H. P. DOUB (Detroit): I believe that Dr. Oakman is to be congratulated for bringing this subject before us, for discussing the literature so thoroughly, and for presenting the collective opinion of the roentgenologists of the country concerning this condition. It is one which is rather infrequently met with, but, nevertheless, is very important because of the many cases referred to us for evidence of possible injury, indicated by pain in this area.

The principal point in this whole discussion is to be able to distinguish between traumatic luxation, fracture, and the anatomical variations which are very common in this bone. This is especially important because these patients who come for examination often have severe symptoms, so that one must make a definite roentgenological diagnosis.

In the study of these cases one finds many variations from the generally accepted normal, but most of them will be found to be due to anatomical variations. In our hospital series a number of cases were operated upon, but, unfortunately, only one of these cases had had X-ray examination previously and the roentgenograms were negative for fracture or dislocation.

From the patient's standpoint, coccygodynia is a very important condition because of the severe pain of which complaint is made. In these cases, however, several conditions should be considered. First, we believe that many of these cases are associated with hysteria and psychosis of some type. In the second place, some of these patients are found to have disease in the sacro-iliac articulation or lumbar spine, with referred pain to the coccyx.

I wish again to congratulate Dr. Oakman upon his presentation of this subject.

DR. JOHN T. FARRELL, JR. (Philadelphia): Dr. Doub has congratulated Dr. Oakman upon his presentation of this subject, but I think the Society is to be congratulated upon receiving such a scholarly discussion of such an important subject.

Pain in the back is very important to the patient, and it is also important to the doctor. This is particularly true in the case of industrial accidents.

We have all known that variations exist in the coccyx, and I think that Dr. Oakman has well pointed out the importance of fundamental anatomical knowledge. It seems to me that the diagnosis of fracture of the coccyx is rarely going to be made without clinical assistance and digital examination.

There is one point which occurs to me, though it seems almost too obvious to mention, and that is the matter of technic. So many of us in dealing with conditions of the spine in clinics are confronted by men who refer patients for just general spinal examination. It is true that it is often impossible to localize the lesion, but in general I think we may say that the smaller the film in relation to the area of suspected involvement, so much more exact will be the information that is ob-

tained. I do not think these studies should ordinarily be made on a 14 by 17 film, a size which would include the entire lumbar column. It is our practice to make them on a 10 by 12, to cover the painful area, and I think the information we obtain is apt to be more definite. This, of course, predicates co-operation on the part of the surgeon, the attending physician, and the receiving ward.

DR. OAKMAN (closing): Dr. Doub, in his discussion, referred to certain indications which are associated with coccygeal pain. It is quite true that the profession at one time, and in particular the gynecologist, was very apt to attribute coccygeal pain to pelvic conditions. I think that a more common-sense view is now prevalent, which attributes almost all cases of coccygeal pain to coccygeal pathology.

The subject of coccygeal pain is of occasional importance in industrial work. This was brought out some seventeen years ago by a French writer, and numerous cases are recorded in the literature, cases wherein injuries to the coccyx have proved to be compensation cases.

One or two writers have insisted that dislocations have never occurred except at the sacro-coccygeal junction. Some of the slides which I have shown indicate that a dislocation may occur at other points.