her present condition operation seemed out of the question, so I watched her carefully day by day and gradually the symptoms of the upper abdomen disappeared and were replaced by an area of dulness and tenderness in the lower abdomen. To make a long story short, when her condition justified it I opened the abdomen and found we were dealing with an ectopic gestation. From a pint to a quart of partially organized blood-clot was removed together with the sac. There was no post-operative shock, and convalescence was rapid and uneventful.

Unfortunately the Episcopal Hospital is so far removed from the center of the city as to be inaccessible both for the casual visitor and student alike. This isolation is a great drawback, as there is nothing so stimulating to the whole staff of a hospital, from the highest to the lowest officer, as the constant criticism and searching inquiry of those who are seeking useful information in modern methods of procedure. Because of its isolation the physical equipment of the hospital is known to few of the profession, resident and non-resident. Perhaps the most favorably situated of the larger hospitals for service to the working classes, it has a wealth of material representing the whole field of surgery. Of the lesions of the extremities, there is an extraordinary opportunity to study fractures of every description, and of the abdominal lesions there is a veritable mine of examples of inflammatory conditions of the pelvis, most of which are the result of improper care at childbirth at the hands of incompetent midwives or the patients themselves. To the philanthropically inclined I know of no better object for investment than the establishment of a maternity department for the poor of that district.

The service of this hospital, as of many others, is an interrupted one. The disadvantage of this system pertaining in many institutions is well recognized and so patent as to admit of no dispute. Far better is the European system, where in each hospital a limited number of surgeons devote their entire time to the instruction of young physicians and surgeons and the utilization of the material at their command for the advancement of medicine as a science and an art.

STATED MEETING, HELD OCTOBER 2, 1911

The Vice-President, Dr. G. G. Davis, in the Chair.

EXCISION OF THE ASTRAGALUS FOR FRACTURE-DISLOCATION.

Dr. Astley P. C. Ashhurst presented a man aged 45 years, who was admitted to Dr. Frazier's service in the Episcopal Hospital on August 2, 1911. He had just fallen a height of about 8 or 9 feet, into a hole, landing on his feet, and injuring the left ankle.

Examination showed considerable swelling around the left ankle, but the skin was unbroken. The foot was held in slight plantar flexion but could not be brought up to a right angle with the leg; plantar flexion was possible to the same degree as in the uninjured foot. Lateral motions were very painful and limited. The leg bones were uninjured. The head of the astragalus could be felt beneath the skin, anterior to its normal position, but still articulating with the scaphoid, and retaining its normal relation to the cuboid; beneath the tendo Achillis the posterior margin of the astragalus could be felt indistinctly. The foot was in slight "cavus" position, the anterior tarsus and metatarsus dropping.

A skiagraph (Fig. 1) showed a transverse fracture through the neck of the astragalus, the posterior fragment being dislocated backward leaving only about half of its articulating surface still in contact with the mortise of the ankle-joint. The relation of the posterior half of the astragalus to the calcaneum was not disturbed. The anterior fragment of the astragalus was dislocated forward and outward, the fragments of the astragalus being separated by about one inch and a half.

The dislocation was irreducible, so it was determined to incise the soft parts and if reduction still was impossible, to excise both fragments of the astragalus.

Operation, August 5, 1911, three days after injury. No Esmarch band was employed. An incision about two and a half inches long was made from below the external malleolus forward

to the extensor tendons. A hæmatoma was evacuated from between the fragments; the external lateral ligament of the ankle was found ruptured; the fragments of the astragalus were about an inch and a half apart, and a few loose fragments were present, also belonging to the astragalus. Reduction of either fragment proved impossible. The anterior fragment was then excised without much trouble; but removal of the posterior fragment was very difficult, though finally it was delivered entire, after division of the tendo Achillis (subcutaneous tenotomy). The ruptured external lateral ligament was sutured with chromic catgut, and the wound was closed with buried and skin sutures of the same material. A small rubber tube was introduced into the ankle-joint for drainage, and the foot and leg were encased in plaster of Paris. The time of the operation was about an hour and a half.

The day after the operation the rubber tube was removed through a small window cut in the gypsum case, but the case itself was not removed for six weeks. There was no rise of temperature after the operation, and the wound was found cleanly healed and the sutures absorbed at the first dressing, six weeks after operation. Another gypsum case was worn for a week longer, and the patient encouraged to use the foot in walking.

The photograph (Fig. 3) made seven weeks after operation shows slight thickening and shortening of the foot. Flexion and extension are very nearly normal in extent and painless. Lateral motion is restricted, but sufficiently free, and painless. There is scarcely any disability, and the patient already can walk several squares. Fig. 2 is a skiagraph made eight weeks after operation.

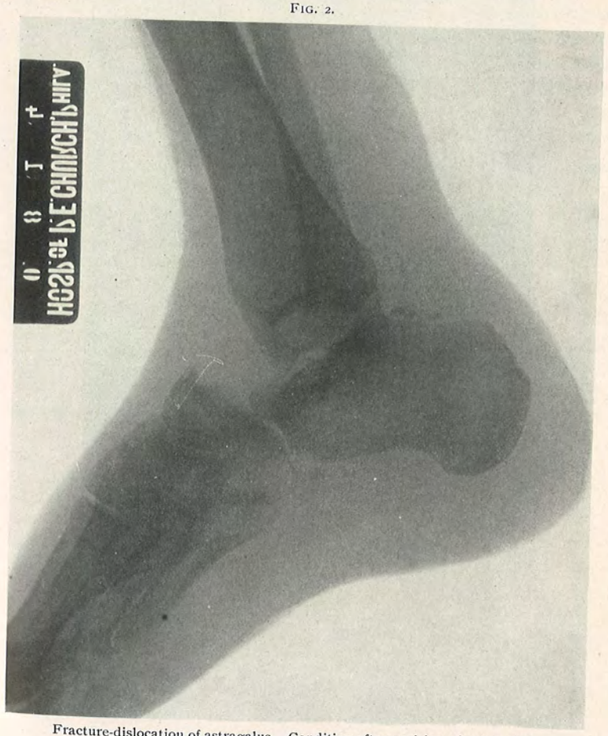
Dr. George P. Müller reported a somewhat similar case seen in the University Hospital in Dr. Frazier's service. The patient, a man 50 years old, had an iron beam fall on his foot. There was a dislocation of the internal cuneiform, inwards and forwards, and a fracture of the second metatarsal, the fragments remaining in good position. He was unable to reduce the dislocation under anæsthesia or after making an incision, and accordingly sawed off the projecting portion. There is now good function.

Dr. G. G. Davis recalled a case of dislocation of the scaphoid in which the bone was still out; it was an old case. It seems that the bone never goes back again, its position not altering much. Dr. Ashhurst's case shows that the good results are lasting, even after as big a bone as the astragalus is removed.

Fig. 1.

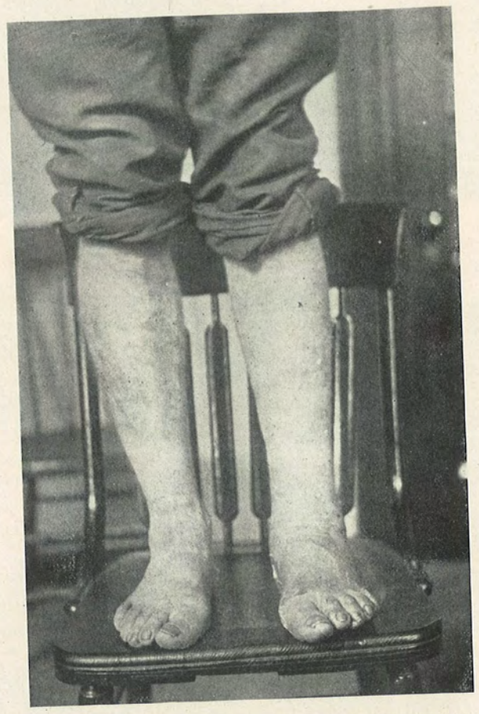
Fracture-dislocation of astragalus.

Fig. 2.



Fracture-dislocation of astragalus. Condition after excision of astragalus.

FIG. 3.



Showing result seven weeks after excision of astragalus for fracture-dislocation.

DR. T. TURNER THOMAS had seen two cases of subastragaloid dislocation, in one of which he knew there was a fracture and in the other he believed there was. His own case, which was not compound, was a subastragaloid dislocation with a fracture of the astragalus. He had a great deal of trouble trying to reduce the dislocation. He looked up the literature, and found in most of the reported cases of subastragaloid dislocation there was great trouble in reduction. It seemed to him that when dislocation is associated with fracture of the astragalus the reduction becomes extremely difficult. Some cases, for some reason, go back easily, others, and these the majority, do not go back in spite of the pushing and pulling. His patient, a man of 60 years, was thrown from a horse; the foot was turned at right angles to the leg. Under ether a vigorous attempt at reduction was made, which was only partially successful. The following day after a consultation with Professor J. William White, the patient was again etherized after Dr. Thomas had made an effort to study out the problem on the cadaver, using one of Dr. Davis's anatomical specimens, upon which he based a theory as to the difficulty to be overcome, and he secured an easy apparent reduction. He put on a plaster case. A week later he took off the case but the reduction was not complete, and he had since had a good deal of trouble with that foot. The last time he saw the patient he was somewhat worse than when he took off the case. In some of these cases the patients have not only lost their limbs, but in some instances their lives.

He had the opportunity of seeing another case with Dr. A. C. Wood at the Philadelphia Hospital less than a year ago. His own case had been of the internal variety while Dr. Wood's was of the external variety. Under ether a pull was made on the foot (Dr. Wood fixed a sling about the foot) and the whole thing slipped easily into place.

A STUDY OF SPRAIN-FRACTURE.

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AND

LEVER FLEGAL STEWART, M.D.,

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SPRAIN-FRACTURE, a condition resulting from an increase in tension on tendon or ligament, or from direct violence at the seat of tendinous or ligamentous attachment to bone, is a separation of all or part of that bone to which tendon or ligament is attached, from that bone of which it formed a part.

Callender,[1] in 1870, first described "cases in which some ligament is torn, carrying with it a film or shell of bone into which its fibres are inserted," and called them sprain-fractures. Keen, in 1874, referred to the same pathological condition as "masked fracture." Ross and Wilbert[2] in 1902 drew attention to sprain-fractures in connection with so-called sprains. Bennett[3] in 1906 said, "sprains commonly so called are in quite a large proportion of cases complicated by slight fractures (pathologically 'unimportant');" again, "a fracture can hardly occur without a sprain at the same time, but a sprain may of course and frequently does occur without a fracture." Eisendrath[4] says: "the recognition of sprain-fractures requires the systematic use of the X-ray in every case of severe sprain."

SPRAIN-FRACTURE AT THE GERMAN HOSPITAL.

In the German Hospital during the year 1910, 89 or 15 per cent. of the fractures confirmed by X-ray were sprain-fractures. During the first five months of the present year 56 cases of sprain-fracture were diagnosed, being confirmed by X-ray.

The importance of sprain-fracture as attested by its frequency and its location (for being produced most often through the agency of ligaments or tendons it is found at the attachments of these, therefore mostly at or near joints) prompted the writers to study it from a clinical and experimental point of view.

CASES VERIFIED BY X-RAY.

Case 1.—Jan. 20, 1910, W. H. R., age 37. X-ray findings: sprain-fracture lower end radius.

Case 2.—Jan. 24, 1910, Sarah D., age 47. X-ray findings: old sprain-fracture external malleolus.

Case 3.—Jan 26, 1910, Frank S., age 35. X-ray findings: sprain-fracture internal condyle of humerus.

Case 4.—Jan. 28, 1910, Wilh. F., age 63. X-ray findings: old sprain-fracture acromion.

Case 5.—Feb. 10, 1910, Philip O., age 51. X-ray findings: sprain-fracture internal condyle of humerus.

Case 6.—Feb. 14, 1910, John S., age 30, X-ray findings: sprain-fracture internal condyle of femur.

Case 7.—Feb. 16, 1910, Wm. R., age 27. X-ray findings: old sprain-fracture external malleolus.

Case 8.—Mar. 16, 1910, Herb. S., age 19. X-ray findings: sprain-fracture proximal phalanx thumb.

Case 9.—Mar. 19, 1910, Erw. W., age 22. X-ray findings: sprain-fracture internal condyle of humerus.

Case 10.—Apr. 12, 1910, B. McN., age 21. X-ray findings: sprain-fracture lower end tibia.

Case 11.—Apr. 13, 1910, Anna P., age 49. X-ray findings: sprain-fracture internal condyle of humerus.

Case 12.—Apr. 18, 1910, Phil. Pf., age 24. X-ray findings: sprain-fracture fifth metatarsal.

Case 13.—Apr. 22, 1910, Mike M., age 26. X-ray findings: old sprain-fracture internal condyle of humerus.

Case 14.—Apr. 23, 1910, M. Mat., age 45. X-ray findings: sprain-fracture astragalus and cuboid.

Case 15.—Apr. 25, 1910, J. Ha., age 36. X-ray findings: sprain-fracture first metacarpal.

Case 16.—Apr. 25, 1910, Boers., age 35. X-ray findings: sprain-fracture lower end radius.

Case 17.—May 2, 1910, Geo. H., age 49. X-ray findings: old sprain-fracture lower end radius.

Case 18.—May 3, 1910, Fr. O., age 61. X-ray findings: old sprain-fracture external condyle of humerus.

Case 19.—May 6, 1910, Elan. Es., age 57. X-ray findings: old sprain-fracture acromion.

Case 20.—May 7, 1910, Wm. J. W., age 35. X-ray findings: old sprain-fracture scaphoid.

Case 21.—May 7, 1910, Geo. M., age 36. X-ray findings: sprain-fracture radius, fracture styloid process of ulna, impaction scaphoid, semi-lunar, and radius.

Case 22.—May 9, 1910, Geo. C., age ?. X-ray findings: sprain-fracture external condyle humerus.

Case 23.—May 13, 1910, Roy S., age 17. X-ray findings: sprain-fracture acromion.

Case 24.—May 13, 1910, Fr. S., age 22. X-ray findings: sprain-fracture astragalus.

Case 25.—June 2, 1910, J. Gall, age 36. X-ray findings: sprain-fracture lower end radius, fracture scaphoid and ulnar styloid.

Case 26.—June 2, 1910, McB., age 48. X-ray findings: sprain-fracture upper end of tibia.

Case 27.—June 4, 1910 Dan. R., age 16. X-ray findings: old sprain-fracture upper end of tibia.

Case 28.—June 4, 1910, Lo. Lo., age 42. X-ray findings: sprain-fracture lower end radius.

Case 29.—June 16, 1910, Ed. D., age 21. X-ray findings: sprain-fracture external malleolus.

Case 30.—June 22, 1910, Ash., age 56. X-ray findings: sprain-fracture internal condyle of femur.

Case 31.—June 27, 1910, J. C., age 22. X-ray findings: sprain-fracture external malleolus.

Case 32.—June 28, 1910, M. Mc., age 41. X-ray findings: sprain-fracture external malleolus.

Case 33.—July 12, 1910, Wis., age 24. X-ray findings: sprain-fracture lower end radius.

Case 34.—July 13, 1910, A. H. D., age 50. X-ray findings: sprain-fracture external condyle of humerus.

Case 35.—July 15, 1910, Ma. L., age 55. X-ray findings: old sprain-fracture lower end radius.

Case 36.—July 16, 1910, Fr. G., age 29. X-ray findings: sprain-fracture internal malleolus.

Case 37.—July 22, 1910, Kirs., age 51. X-ray findings: sprain-fracture external condyle of humerus.

Case 38.—July 25, 1910, Wm. B., age 29. X-ray findings: sprain-fracture external malleolus.

Case 39.—July 26, 1910, Ch. M., age 53. X-ray findings: sprain-fracture acromion.

Case 40.—July 26, 1910, J. Th., age 37. X-ray findings: sprain-fracture lower end radius.

Case 41.—July 30, 1910, K. K., age 23. X-ray findings: sprain-fracture upper end tibia.

Case 42.—August 8, 1910, R. McC., age 41. X-ray findings: sprain-fracture external condyle of humerus.

Case 43.—August 18, 1910, D. W., age 25. X-ray findings: sprain-fracture external condyle of humerus.

Case 44.—August 19, 1910, M. McC., age 44. X-ray findings: sprain-fracture external condyle of humerus.

Case 45.—August 31, 1910, H. Ro., age 22. X-ray findings: sprain-fracture external malleolus.

Case 46.—September 8, 1910, R. Oz., age 16. X-ray findings: old sprain-fracture lower end fibula.

Case 47.—September 10, 1910, M. T., age 34. X-ray findings: sprain-fracture first metacarpal.

Case 48.—September 13, 1910, S. M., age 44. X-ray findings: sprain-fracture external malleolus.

Case 49.—September 17, 1910, S. B., age 50. X-ray findings: sprain-fracture acromion.

Case 50.—September 17, 1910, S. Ob., age 52. X-ray findings: sprain-fracture fourth metacarpal.

Case 51.—September 19, 1910, R. G., age 41. X-ray findings: sprain-fracture distal phalanx thumb.

Case 52.—September 19, 1910, E. Long, age 15. X-ray findings: sprain-fracture external malleolus.

Case 53.—September 20, 1910, A. U., age 28. X-ray findings: sprain-fracture external malleolus.

Case 54.—September 23, 1910, E. M., age 26. X-ray findings: sprain-fracture lower end radius.

Case 55.—September 27, 1910, M. K., age 36. X-ray findings: sprain-fracture internal malleolus.

Case 56.—October 7, 1910, J. R., age 20. X-ray findings: sprain-fracture external condyle of humerus.

Case 57.—October 11, 1910, J. Lon., age 13. X-ray findings: sprain-fracture external condyle of humerus.

Case 58.—October 13, 1910, J. B., age 44. X-ray findings: sprain-fracture external malleolus.

Case 59.—October 15, 1910, W. McG., age 44. X-ray findings: sprain-fracture external malleolus.

Case 60.—October 24, 1910, J. H., age 17. X-ray findings: sprain-fracture os calcis.

Case 61.—October 25, 1910, B. S., age 19. X-ray findings: sprain-fracture scaphoid.

Case 62.—October 25, 1910, Fried., age 20. X-ray findings: sprain-fracture external malleolus.

Case 63.—October 28, 1910, Ad. M., age 18. X-ray findings: sprain-fracture external condyle of humerus.

Case 64.—October 29, 1910, G. V., age 17. X-ray findings: old sprain-fracture os calcis.

Case 65.—October 29, 1910, J. C., age 50. X-ray findings: sprain-fracture external condyle of femur.

Case 66.—November 1, 1910, C. B., age 22. X-ray findings: sprain-fracture external malleolus.

Case 67.—November 4, 1910, L. Ab., age 54. X-ray findings: sprain-fracture os calcis.

Case 68.—November 4, 1910, Mike S., age 23. X-ray findings: sprain-fracture internal malleolus.

Case 69.—November 4, 1910, Grif., age 56. X-ray findings: old sprain-fracture head of radius.

Case 70.—November 8, 1910, Gold., age 21. X-ray findings: sprain-fracture external malleolus.

Case 71.—November 9, 1910, Geo. C., age 18. X-ray findings: old sprain-fracture internal tubercle of tibia.

Case 72.—November 10, 1910, P. Cat., age 40. X-ray findings: sprain-fracture internal tubercle of tibia.

Case 73.—November 11, 1910, H. W., age 37. X-ray findings: sprain-fracture astragalus.

Case 74.—November 11, 1910, R. Iz., age 18. X-ray findings: old sprain-fracture external malleolus.

Case 75.—November 12, 1910, Zez., age 30. X-ray findings: old sprain-fracture internal cuneiform.

Case 76.—November 21, 1910, Ch. S., age 39. X-ray findings: old sprain-fracture fourth metacarpal, distal end.

Case 77.—November 22, 1910, M. S., age 52. X-ray findings: sprain-fracture inner tuberosity of tibia.

Case 78.—November 23, 1910, Stu., age 42. X-ray findings: sprain-fracture external condyle of humerus.

Case 79.—November 23, 1910, Ma. M., age 49. X-ray findings: sprain-fracture acromion.

Case 80.—November 26, 1910, E. B., age 50. X-ray findings: sprain-fracture upper end humerus.

Case 81.—November 28, 1910, Wm. S., age 54. X-ray findings: sprain-fracture greater tuberosity humerus.

Case 82.—December 6, 1910, E. S., age 46. X-ray findings: old sprain-fracture greater tuberosity humerus.

Case 83.—December 14, 1910, J. D., age 43. X-ray findings: old sprain-fracture cuboid and os calcis.

Case 84.—December 21, 1910, Al. C., age 29. X-ray findings: old sprain-fracture external condyle of femur.

Case 85.—December 22, 1910, J. Lo., age 48. X-ray findings: sprain-fracture internal condyle of humerus.

Case 86.—December 23, 1910, M. D., age 25. X-ray findings: old sprain-fracture external malleolus.

Case 87.—December 27, 1910, Alex. K., age 41. X-ray findings: sprain-fracture both condyles of humerus.

Case 88.—December 27, 1910, J. B., age 51. X-ray findings: sprain-fracture os magnum.

Case 89.—December 28, 1910, Pat. C., age 30. X-ray findings: sprain-fracture external malleolus.

Case 1.—January 5, 1911, N. C., age 18. X-ray findings: old sprain-fracture proximal end metacarpal.

Case 2.—January 16, 1911, S. R., age 14. X-ray findings: sprain-fracture external malleolus.

Case 3.—January 26, 1911, J. J. K., age 60. X-ray findings: sprain-fracture greater tuberosity humerus.

Case 4.—January 30, 1911, Thos. C., age 23. X-ray findings: sprain-fracture head radius, comminuted fracture olecranon.

Case 5.—January 31, 1911, Al. R., age 55. X-ray findings: sprain-fracture acromion.

Case 6.—February 6, 1911, Al. M., age 21. X-ray findings: sprain-fracture lower end radius.

Case 7.—February 6, 1911, Ed. C., age 25. X-ray findings: sprain-fracture lower end radius.

Case 8.—February 7, 1911, Duer, age 42. X-ray findings: sprain-fracture external condyle of humerus.

Case 9.—February 7, 1911, I. G., age 34. X-ray findings: sprain-fracture greater tuberosity humerus.

Case 10.—February 8, 1911, Ch. C., age 30. X-ray findings: sprain-fracture internal condyle of humerus.

Case 11.—February 9, 1911, L. H., age 52. X-ray findings: sprain-fracture olecranon.

Case 12.—February 17, 1911, A. H., age 28. X-ray findings: sprain-fracture astragalus.

Case 13.—February 20, 1911, J. W., age 48. X-ray findings: old sprain-fracture greater tuberosity humerus.

Case 14.—February 20, 1911, F. P. M., age 33. X-ray findings: sprain-fracture internal condyle humerus.

Case 15.—February 28, 1911, T. D., age 46. X-ray findings: old sprain-fracture lower end radius.

Case 16.—March 2, 1911, J. C., age ?. X-ray findings: sprain-fracture lower end radius.

Case 17.—March 7, 1911, F. H., age 48. X-ray findings: sprain-fracture lower end radius.

Case 18.—March 8, 1911, L. F., age 23. X-ray findings: sprain-fracture cuneiform.

Case 19.—March 14, 1911, A. B., age 22. X-ray findings: old sprain-fracture external malleolus.

Case 20.—March 14, 1911, S. Br., age 62. X-ray findings: old sprain-fracture greater tuberosity humerus.

Case 21.—March 17, 1911, S. H., age 38. X-ray findings: sprain-fracture scaphoid.

Case 22.—March 18, 1911, Ot., age 50. X-ray findings: sprain-fracture greater tuberosity humerus.

Case 23.—March 18, 1911, L. R., age 66. X-ray findings: old sprain-fracture acromion, luxation humerus.

Case 24.—March 18, 1911, C. K., age ?. X-ray findings: sprain-fracture upper end tibia.

Case 25.—March 23, 1911, J. S., age 33. X-ray findings: sprain-fracture external malleolus.

Case 26.—March 23, 1911, M. M. C., age 30. X-ray findings: sprain-fracture post. lip head of radius.

Case 27.—March 25, 1911, Hul., age 35. X-ray findings: sprain-fracture scaphoid.

Case 28.—March 27, 1911, E. A., age 28. X-ray findings: sprain-fracture external malleolus.

Case 29.—March 27, 1911, M. H., age 28. X-ray findings: old sprain-fracture scaphoid.

Case 30.—March 28, 1911, G. W., age 25. X-ray findings: sprain-fracture acromion.

Case 31.—April 8, 1911, F. H., age 41. X-ray findings: sprain-fracture external malleolus.

Case 32.—April 10, 1911, J. G., age 48. X-ray findings: sprain-fracture distal end of third metacarpal.

Case 33.—April 11, 1911, H. M., age 46. X-ray findings: sprain-fracture lower end radius.

Case 34.—April 15, 1911, Pit., age 36. X-ray findings: sprain-fracture outer tuberosity tibia.

Case 35.—April 18, 1911, S. N., age 18. X-ray findings: old sprain-fracture greater tuberosity humerus.

Case 36.—April 22, 1911, J. R., age 72. X-ray findings: old sprain-fracture astragalus.

Case 37.—April 22, 1911, J. Mc., age 41. X-ray findings: sprain-fracture cuboid.

Case 38.—April 22, 1911, C. C., age ?. X-ray findings: sprain-fracture acromion.

Case 39.—April 29, 1911, J. C., age 37. X-ray findings: sprain-fracture styloid process of radius.

Case 40.—May 2, 1911, Ed. F., age 50. X-ray findings: old sprain-fracture greater tuberosity humerus.

Case 41.—May 4, 1911, M. N., age 50. X-ray findings: sprain-fracture cuneiform.

Case 42.—May 4, 1911, Hug., age 29. X-ray findings: sprain-fracture astragalus.

Case 43.—May 5, 1911, C. McK., age 19. X-ray findings: sprain-fracture external malleolus.

Case 44.—May 6, 1911, E. M., age 52. X-ray findings: old sprain-fracture external malleolus.

Case 45.—May 8, 1911, Koe., age ?. X-ray findings: sprain-fracture os calcis.

Case 46.—May 8, 1911, C. S., age 14. X-ray findings: sprain-fracture fifth metatarsal.

Case 47.—May 8, 1911, J. L., age ?. X-ray findings: sprain-fracture lesser tuberosity humerus.

Case 48.—May 10, 1911, Wm. T., age ? X-ray findings: sprain-fracture astragalus.

Case 49.—May 17, 1911, C. K., age 68. X-ray findings: old sprain-fracture acromion.

Case 50.—May 18, 1911, J. DeL., age 28. X-ray findings: sprain-fracture inner head tibia.

Case 51.—May 19, 1911, R. Gerl., age 40. X-ray findings: sprain-fracture distal phalanx little finger.

Case 52.—May 22, 1911, M. H., age 21. X-ray findings: sprain-fracture scaphoid.

Case 53.—May 26, 1911, M. G. Al., age 24. X-ray findings: sprain-fracture external femur.

Case 54.—May 26, 1911, Ben. G., age 47. X-ray findings: sprain-fracture acromion.

Case 55.—May 31, 1911, C. M., age ? X-ray findings: sprain-fracture lower end radius.

Case 56.—June 1, 1911, A. McD., age 26. X-ray findings: sprain-fracture inner tuberosity tibia.

Of these 145 cases, 46 were in the ankle; 25 the wrist; 25 the elbow; 23 the shoulder; 15 the knee; 9 the hand; and 2 were in the anterior foot region. With the ankle and wrist cases the tarsal and carpal bones have been respectively included. Twenty-eight of the ankle fractures were of the malleoli, and of these 24 were of the external malleolus; being within one of the number of sprain-fractures found at the wrist and over 16 per cent. of this series. Thirty-three of these cases were old (aged three weeks or more). All of these cases suffered as a result of either being treated as a sprain or receiving no treatment.

Most of these cases were caused by indirect violence; a few were caused by direct violence.

As to age, 3 were under fifteen years; 14 were between the ages of fifteen and twenty; 37 between twenty and thirty; 24 between thirty and forty; 30 between forty and fifty; 22 between fifty and sixty; and 7 over sixty. Though there are histological differences in the tissues of adults and children, the same pathology and comparative frequency of sprain-fracture is found in children as in adults.

In the experience of the writers it has been possible to diagnose clinically 77 per cent. of the sprain-fractures shown up by X-ray. Of the remaining 23 per cent., 1 was diagnosed osteoperiostitis, 1 luxation, and the rest sprain, or

contusion. In a small percentage of cases that the X-ray did not demonstrate to be sprain-fractures, the diagnosis of sprain-fracture was made. These cases were probably sprain-fractures impossible of demonstration by X-ray.

SYMPTOMS.

There is always a history of application of sufficient force to cause fracture. Pain is seldom very severe. Tenderness, marked and sharply localized over a region of tendinous or ligamentous attachment, is a most important sign. Bone crepitus is very rarely elicited, however joint crepitus is not infrequently present. Preternatural mobility is seldom met with, as these injuries alone are rarely extensive enough to permit of it. Swelling usually occurs and is sharply localized, excepting when synovitis of the joint is present. Deformity is usually present, due most often to swelling at the seat of injury. Ecchymosis, a later sign, is rarely seen. Total disability never occurs and most often there is but little disturbance of function, excepting that disturbance caused by pain.

In old sprain-fractures the tenderness is latent; seldom is it absent. The symptoms of an arthritis are added when actual joint cavities have been involved. Ecchymosis, if originally present, has disappeared at this stage.

EXPERIMENTS IN PRODUCTION OF SPRAIN-FRACTURE.

The following experiments were carried out on dogs, completely anæsthetized with ether, at the Laboratory of Experimental Surgery of the University of Pennsylvania, in order to determine the strength of tendon and ligament as compared with bone. All of the dogs were asphyxiated with gas before recovering from their anæsthesia.

Experiment I.—The skin, ligamentum patella, and all tendon attachments around the left knee-joint were severed. The femur was held in a vice and the leg was grasped with the hand and hyperextended and twisted until the joint was flail-like (subluxated).

Examination showed no gross lesions of the capsule. Further opening of the joint showed the external lateral ligament partly torn from its attachment to the external condyle of the femur; the tear involved the osseous and not the ligamentous tissue (a sprain-fracture). The tear

was due evidently to a lateral twist, as it did not occur in the direction of the course of the ligament.

(The above experiment was done after it was found that weight aggregating 160–175 lbs., hung from the tibia, would not make the joint give way.)

Experiment II.—The right thigh was grasped in the left hand and the corresponding leg in the right hand; twisting and hyperextension were done.

Incision and examination showed epiphyseal separation of the head of the tibia, sprain-fracture at the attachment of the patellar ligament to the tibia (the tendon pulling away with it small pieces of bone), and fracture of the crest of the tibia at the epiphyseal junction. No lesions of the knee-joint ligaments, tendons, or bones were found on exposing the joint.

Experiment III.—The left scapula was grasped in the right hand, and the corresponding humerus in the left hand. All motions encountering resistance were persisted in until that resistance was overcome.

Incision and examination showed the shoulder-joint to be undisturbed; but a badly comminuted fracture extending from a short distance beyond the glenoid fossa throughout the rest of the scapula was found.

Experiment IV.—An incision was made over the left knee-joint. The tendon of the quadriceps extensor muscle was cut and freed laterally, grasped in a vice near the tibial end of the patella, and traction was made by the use of weight pulling from the tibia in the normal direction of the tendon.

The patellar ligament separated at the point where the vice grasped it and also broke away from its tibial attachment at one corner, bringing bony tissue with it. Fibrillar tears were noted in the ligament. Failure to have the patellar ligament grasped throughout its breadth may have influenced the results. The vice grip on the ligament no doubt weakened it at this point of pressure.

Experiment V.—The tendon of the semimembranosus muscle was exposed, grasped near its centre in a vice, and traction was made by weights in its natural direction.

The tendon ruptured at the point where it was grasped. No change in its bony attachment was found. In this as in the rest of the cases the vice grip devitalized the tendon at the point at which it was grasped.

Experiment VI.—Same as Experiment IV. Examination showed no rupture of the quadriceps extensor tendon but division of bone at the point of attachment of the tendon. The tendon had pulled the bony tissue to which it was attached away from the tibia.

Experiment VII.—The tendon of origin of the right biceps was exposed and tension was made in its natural direction in the usual way.

Examination showed that the tendon had pulled away the bony cap to which it was attached. The tendon tissue showed no signs of injury.

Experiment VIII.—All skin was removed from the region of the left ankle-joint. All of the tendons passing between points above and below the joint were severed. The tibia was held tightly in a vice. A two-pronged hook was hung from the foot; one prong was hooked around the

os calcis, while the other was hooked around the foot over the anterior tarsal bones; weights were hung on the hook.

Fracture of the calcaneum involving the surface articulating with the astragalus resulted. No ligamentous tears were found.

Experiment IX.—Same as Experiment IV. Examination showed no rupture of the patellar ligament but rupture of the bony tissue to which it was attached.

Experiment X.—The tendon of the right tibialis anticus was isolated. Tension was applied in the usual way.

Examination showed no tendon injury but a pulling away of the bone to which the tendon was attached.

Experiment XI.—The skin was removed from the right ankle-joint. The tendo Achillis was cut and the distal end of it was grasped in a vice, weights were added, and a pull was made in the direction which the tendon followed. The foot was held in a vice. Vice No. 1 slipped from the tendon, seemingly isolating three parts. The experiment was repeated on that part of the tendon which was overlapped by the other two parts of the tendon.

Bony tissue of the posterior surface of the calcaneum pulled away with the tendon. This portion of tendon last tested was uninjured.

Experiment XII.—Same as Experiment VIII. The hook slipped from its attachment after some pulling force had been brought to bear.

Examination showed that the anterior band of the external lateral ligament of the ankle had pulled away some bony tissue at its point of attachment to the astragalus. No injury of the ligament occurred.

Experiment XIII.—Same as Experiment V. Examination showed that the semimembranosus tendon had pulled away the bony tissue to which it was attached. The tendon was uninjured.

Experiment XIV.—Same as Experiment IV. Examination showed no injury of the patellar ligament which had pulled away the bone at its point of attachment to the tibia.

Experiment XV.—The left hip was exposed; all of the muscular attachments in this region were cut, leaving the articulation surrounded by its capsule alone. The femur was rotated externally and abducted, producing a luxation.

Examination showed a tear of the weak upper postero-external portion of the capsule and a sprain-fracture at the insertion of the ligamentum teres.

In these fifteen experiments done by using pulling force on tendons and ligaments at some distance from the attachment of them to bone, bone gave away in every test but one. This was the semimembranosus tendon which ruptured where it was gripped by the vice. In another instance besides pulling away some bony tissue the patellar ligament ruptured where it was grasped by the vice. In both cases the ligaments were weakened by the vice grip, and in the latter case the

patellar ligament was not grasped throughout its horizontal extent. In a third case showing sprain-fracture at the insertion of the ligamentum teres, luxation of the joint with laceration of the weaker portion of the capsule (that portion of the capsule, the sole function of which is to support the synovial membrane and fluid) was produced. In every other instance (12 out of the 15) bone alone gave way. These experiments show how the frequent occurrence of sprain-fracture is possible, and how rupture of tendon or ligament as a part of the pathology of so-called sprain is impossible.

One striking feature of the experiments was the occurrence of sprain-fracture in the two instances of luxation. The integrity of joints is maintained by strong ligaments, and in order to have a luxation one or more of the strong ligaments must give way; we have shown that ligaments themselves do not give way, but the bony tissue to which they are attached gives way, therefore we think that probably all luxations are permitted by the primary occurrence of a sprain-fracture.

Upon this subject the writers expect to have more to say in the future.

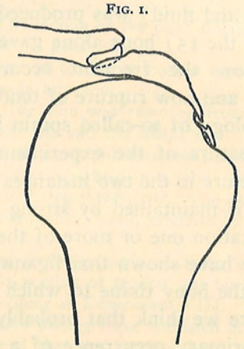
DIAGNOSIS.

The X-ray of course makes diagnosis conclusive when sprain-fracture is demonstrated. Through the courtesy of Dr. A. G. Miller (Skiagrapher to the German Hospital) the writers have been able to make schematic representations of some of his plates (Figs. 1 and 2, 1911, show sprain-fractures easy of demonstration). However, a negative X-ray in the presence of suggestive clinical signs should not exclude the possibility of sprain-fracture, chiefly for three reasons: first, experience and skill are required in the making and interpretation of X-ray plates (Figs. 3 and 4, 1911, and 5, show conditions such as one of little experience might find it difficult to diagnose); second, the X-ray picture if not taken in the proper plane may not show a really quite distinct sprain-fracture (Figs. 6 and 7 represent plates from cases of sprain-fracture that showed no signs of sprain-fracture in plates taken in other planes); third, some sprain-fractures are so slight as to escape the detection of the most capable

skiagrapher (Fig. 4, 1911, may be again referred to as one approaching that class).

Clinically, history of sufficient injury with a small, sharply localized area of swelling and acute tenderness over a region

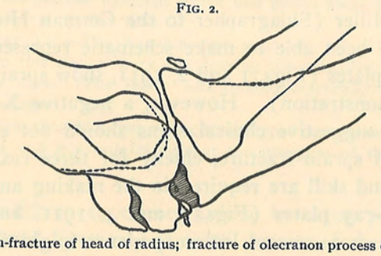
FIG. 1.



Sprain-fracture of greater tuberosity of humerus.

of tendinous or ligamentous attachment is diagnostic of sprain-fracture, and should be considered as such whether or not X-ray verifies the diagnosis. Tenderness of lesser degree

FIG. 2.

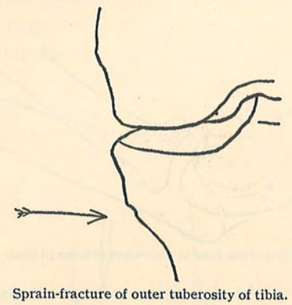


Sprain-fracture of head of radius; fracture of olecranon process of ulna.

may surround an acutely tender area. Tenderness lasts as a rule from five to twenty days, longer in improperly treated cases; however, those few cases with symptoms as given above, in which tenderness disappears within forty-eight hours, are nevertheless sprain-fractures. The acute tenderness which

we have referred to is unmistakable; when the spot is firmly pressed on the patient invariably winces.

FIG. 3.

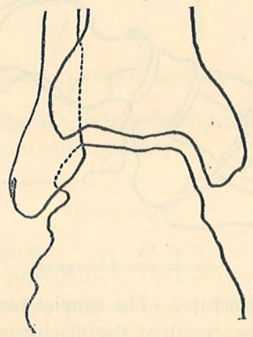


Sprain-fracture of outer tuberosity of tibia.

DIFFERENTIAL DIAGNOSIS.

Tenderness and swelling or both, not sharply localized, with the tenderness not so acute (not causing wincing on firm pressure) are occasionally found in joint regions. These

FIG. 4.

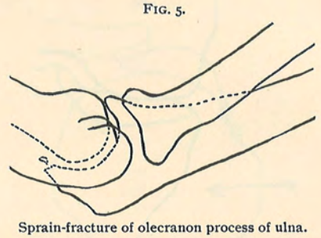


Sprain-fracture of external malleolus of fibula.

symptoms have four causes: the first is contusion, resulting from direct injury; the second is strain, the placing of tension on tendons, ligaments, or other soft parts (nerve injury cannot be confused with sprain-fracture, as symptoms rela-

tive to its origin and distribution are associated); the third is rupture of diseased tendons or ligaments (a very rare occurrence that can be considered only as a complication of disease); the fourth is a luxation that has reduced itself.

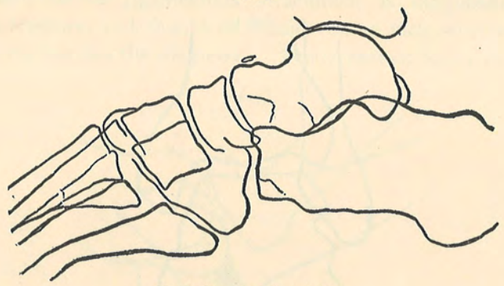
FIG. 5.



Sprain-fracture of olecranon process of ulna.

Bennett gives the old definition of sprain as "a wrench or strain resulting in stretching or laceration of the soft parts without external wound." The writers have proven that laceration of soft parts does not occur; where laceration occurs

FIG. 6.



Sprain-fracture of astragalus.

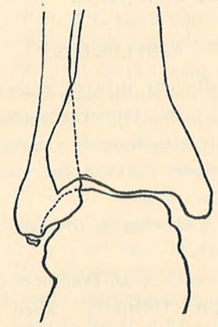
we have a sprain-fracture. The simpler term strain we have already given to the result of the placing of tension on soft parts. The word sprain, standing alone, we eliminate; but using it with fracture the condition formerly looked upon as severe sprain is described. Self-reduced dislocations show in many instances rupture of the weaker portion of the capsule. As intimated before, a more careful search for such a condi-

tion may reveal the presence of a sprain-fracture in luxations, it being of course at a different seat from the tear of the capsule.

A painful swollen joint, generally tender, with no history of injury and a negative X-ray, if you like, speaks for acute arthritis; a similar history, less marked, speaks for chronic arthritis.

A fairly large, tender, indefinite swelling following direct injury, and most likely not seated at a point of tendinous or

FIG. 7.



Sprain-fracture of external malleolus of fibula.

ligamentous attachment, points to osteoperiostitis. X-ray findings make differentiation more easy.

TREATMENT.

The seat of fracture together with the joint nearest the fracture should be immobilized. When carpal or tarsal bones are involved, the wrist- or ankle-joint should be immobilized with the smaller joints. Plaster of Paris serves this purpose best in the upper as well as the lower extremity, and rest of the body, for absolute rest is essential. Casts should be used for three weeks; at the end of this time, moderate motion may be started. Massage should be begun at the end of ten days. In an uncomplicated case, fairly free use of the injured tissues

can be allowed at the end of the sixth week. This treatment is arbitrary, and must of course be influenced by the individual case. General relaxation of joints may follow as a result of treatment, if care is not taken to avoid muscular atrophy. Proper treatment gives excellent results which are permanent.

Lack of treatment and treatment as sprain (drug-store treatment) provide many cases of chronic arthritis, deformity, persistent pain, and weakness; excessive callus formation is a common result; non-union, permitting the free bony tissue to catch between joint surfaces, can occur.

CONCLUSIONS.

1. History of sufficient injury, with a sharply localized area of swelling and acute tenderness over a region of ligamentous or tendinous attachment, means sprain-fracture.

2. X-ray is not essential for the recognition of sprain-fracture.

3. The external malleolus is probably the most frequent seat of sprain-fracture.

4. About 15 per cent. of all fractures are sprain-fractures.

5. That condition, formerly called severe sprain, is sprain-fracture.

6. The condition resulting from stretching of soft parts is better termed strain.

7. Sprain-fracture is probably a part of the pathology of every dislocation.

8. If in doubt as to whether or not sprain-fracture has occurred, treat as sprain-fracture.

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DR. GEORGE G. ROSS said that this question of sprain-fracture is one in which he had long been interested. He had felt that the so-called explanation of sprains was very inadequate. Text-books all say that a sprain is an injury about a joint in which the tendons are stretched or torn. Tendons and ligaments are made of white fibrous connective tissue which is absolutely inelastic and of great strength, being the strongest tissue in the human body. He had felt that it was very difficult, if not impossible, to tear or break a normal tendon or ligament. Fortunately the X-ray then came along to help confirm the suspicion that it was the attachment of the tendon or ligament that gave way, and not the tendon or ligament itself. John Ashhurst's Surgery, next to the last edition, has a footnote in which reference is made to Callender's remark on sprain-fracture. He asked Dr. Stewart to take up this matter last summer and do some experimental work. The present paper records the results of this work. It seemed to him that the pathology as explained by Dr. Stewart's experimental and clinical work is conclusive proof that sprain is fracture, and being fracture should be so treated. This fracture has been termed the drug-store fracture, for after a treatment with liniment it comes to the surgeon with what is called a sprained joint which does not get well but remains painful the rest of the patient's life, because it was a fracture that was not properly treated. It seems important enough to warrant treatment of the same as a gross fracture of a bone. The way it occurs is that sufficient violence, not necessarily great in extent, is exerted when the tendons and ligaments about the joint are in a certain state of tension, as, for instance, when a person turns on the side of the foot, putting the external ligament on a great tension, and then a little additional twist is all that is necessary to detach the ligament.

DR. ASTLEY P. C. ASHHURST remarked that sprains, as he understood them, are injuries to joints consisting in the rupture or laceration of ligaments, due to indirect violence. If ligaments do not rupture in their body they must be torn through in their attachments to the bone. There are certain sprain-fractures so typical and recognized that they have received distinct names, such as *Schlatter's disease*, or "starting" of the upper epiphysis of the tibia; the *epicondylitis* of Momberg, or sprain-fracture of the external epicondyle at the elbow. Then there are such cases

as Dr. Wharton reported to this academy several years ago, and of which he had seen several instances, a sprain-fracture of the tuberosity of the fifth metatarsal. However, this last often is due to direct injury, the patient tramping on the outside of the foot. These three types especially he thought deserving of recognition as typical injuries, but most others he should consider as sprains. To have sprain-fractures occurring in 15 per cent. of all sprains increases the total number of fractures to an alarming degree.

Dr. T. Turner Thomas did not believe that all sprains were really sprain-fractures. He had seen in experimental work on the shoulder-joint of cadavers the tearing of the ligament from the glenoid margin and from the humeral attachment without associated fracture. He had on the cadaver repeatedly produced sprains of the ankle by fixing the foot in the vice and pulling the leg over, every time getting a sprain-fracture. Now, he had been doing some work on dislocations of the shoulder and at the bottom of this work is the idea of sprain and sprain-fracture, a dislocation being nothing more than an exaggerated sprain. He believed that the condition described by Codman as due to a subacromial bursitis is the result of sprain-fracture, at the shoulder-joint. Forced abduction is to the shoulder what a lateral turn of the foot is to the ankle, and what forced dorsal flexion from a fall on the hand is to the wrist. The effect of forced abduction on the shoulder is to tear the ligamentous attachment on the axillary side. Rather frequently a tearing off of a small portion of the internal glenoid margin will be produced. He had often found roughness of the glenoid margin. He had found similar fractures reported in the literature. Far more important, and not recognized as such, is a tearing fracture at the shoulder of the greater tuberosity. As abduction is forced it tears the axillary portion of the capsule, and if abduction is continued, as the humerus strikes the edge of the acromion the head is violently forced out and the external rotators with the underlying portion of the capsule pulling back on it give way. This is an extremely important accident, and occurs more frequently than is credited. If one tears off the greater tuberosity with the underlying capsule, or if the capsule alone is torn from the greater tuberosity and these edges become separated, when the dislocation is reduced the head of the humerus drops and this is always associated with severe paralysis of the upper extremity that never completely recovers. He had found that condition associated with a fracture of the greater tuberosity as shown by the X-ray and as shown in the operations by irregularities of the tuberosity. This idea of fracture of the greater tuberosity from forced abduction is in line with the views of the reader of the paper.

In line with the thought that forcible abduction is an important movement, practically all of the dislocations of the shoulder in the adult are anterior dislocations, and the reason is because they are due to forced abduction which is very common and can produce only an anterior dislocation. As the head goes out and the pull comes on the supraspinatus, the infraspinatus, the teres minor and corresponding portion of the capsule, the capsule may tear, the greater tuberosity may tear off, and the subacromial bursa, which lies on and is intimately adherent to the greater tuberosity and tendons attached to it, must be involved in the inflammation, this is the reason why Codman and others have found adhesions in the bursa. Codman has recently reported two cases in which he sutured the two ends of the torn supraspinatus, and he has very much limited the causative factors in subacromial bursitis. He now believes subacromial bursitis is usually due to tearing of the supraspinatus tendon, and this again is frequently replaced by a tearing of the greater tuberosity, so that inflammation in the bursa should be common. Its importance, however, is secondary to the laceration of the axillary portion of the capsule, which is necessary to the mechanism of the tearing of the tendon or the tuberosity. Wherever there is a fracture of the greater tuberosity of the humerus there has been a dislocation of the shoulder, and in those cases in which there is no history of a dislocation, the latter did occur at the moment of forced abduction, but was spontaneously reduced as the arm fell to the side of the body immediately afterward.

Dr. G. G. Davis was under the impression that the reader in his experiments stated that whenever the tendon was pulled until something gave way, that it was the bone which yielded. That such is not always the case in man is shown by the many cases of rupture of the quadriceps, and the biceps tendons, but it raises the question as to whether or not some of these conditions may not be examples of sprain-fractures. We can account for others by disease of the tendon; he had a preparation which shows the long tendon of the biceps very markedly diseased by osteoarthritis, which caused its rupture at its exit from the capsule.

Dr. John H. Jopson said that the truth as brought out in

these cases lies in a middle ground rather than on the plane which the essayist would have us believe, in other words between his position on the one hand and Dr. Ashhurst's on the other. The essayist says that his cases were not attended by laceration of the ligaments of the joint and were therefore not sprains according to Ashhurst. That all sprains and dislocations are attended by fractures of bones he did not think the majority believed. All have operated on cases in which ligaments or tendons have been torn from bones without fracture of the bone, as in rupture of the long head of the biceps, where it has been torn from its point of origin, and in rupture of the quadriceps tendon so-called where the tendon is torn away from its attachment to the bone, probably as often as its separate fibres are torn through. On the other hand fractures frequently accompany both sprains and dislocations. He had operated on a case of dislocation of the shoulder attended by fracture of the anatomical neck of the humerus in which the anterior lip of the glenoid cavity was torn off.

Dr. George G. Ross rejoined that the point they made is that it is the periosteum and the bone to which the ligament is attached that gives way and not the white fibrous tissue. They believed these so-called sprains are fractures of a minor degree. With regard to the quadriceps extensor above the patella he had seen one case of complete tear of the ligamentum patellæ without fracture. The patient was a colored man of 80 and his tendons and ligaments were all in a state of senile pathology that predisposed toward tearing. He did not deny the fact that he had seen a tear of the tendon of the quadriceps extensors, but the vast majority near the joints are sprain-fractures, and he believed this to be the true pathology of sprains.

Dr. Willis F. Manges agreed with the essayist that the occurrence of sprain-fracture is far more common than has heretofore been appreciated. He found this out by his X-ray work. It is surprising how small a fragment of bone can sometimes be clearly demonstrated. On the shoulder-joint particularly, where the condition is sometimes called a subdeltoid or subacromial bursitis, he had often taken the view that we are dealing with a sprain-fracture to which little attention was paid at the time of injury, and there has ensued an inflammation which remains more or less chronic until a subsequent wrench produces violent pain in that

region. On the other hand, he believed that there are quite severe sprains or injuries around the joints where there is certainly no demonstrable portion of bone torn from the bone. Whether or not the ligament itself tears, or its attachment tears without fracturing the bone, he could not say. He did know, however, that the sprain-fracture is not uncommon.

Dr. Astley P. C. Ashhurst added that he recognized a fracture, a sprain, and a "sprain-fracture," but to call all these injuries, which have heretofore been called sprains, sprain-fractures, he thought would only serve to add confusion to what already is sufficiently clear. As to the possibility of ligaments being torn elsewhere than at their insertions, in the patient he showed earlier in the evening he found that the external lateral ligament of the ankle-joint had been torn through the centre; there was no fracture of the fibula or calcaneum which he could see. The rupture had taken place through the body of the external lateral ligament and he sewed it up again.

Dr. Morris Booth Miller said that a distinction should be made between a sprain which involves solely the ligaments and a strain which is an injury to tendons, fascia, or muscles. A look at the specimens presented by the essayist shows that they represent shells of bone pulled off by tendons and hence are examples of fracture strains and not fracture sprains.

Dr. G. G. Davis added that in making artificial luxations on the cadaver sometimes are found shells of bone sticking to the band-like ligaments, but at other times the bony edges are not broken. As to the question of relative frequency, and to solve this question, more careful radiographic observations must be made.

Dr. Lever F. Stewart (in closing) said that in these experiments, which, by the way, were done on living dogs, it was found that the sprain-fractures were sometimes so infinitesimal that they could not see but could only palpate the fragments. It is quite reasonable to suppose that in these cases the X-ray cannot demonstrate such small lesions. He referred to what had formerly been called severe sprains as sprain-fractures, and suggested that similar cases with symptoms of less severity were better called strain than sprain, providing, of course, that sprain-fracture is not demonstrated in them.

FRACTURE OF THE FLOOR OF THE ACETABULUM.

WITH SEVEN ILLUSTRATIVE CASES.

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AND

HENRY K. PANCOAST, M.D.,

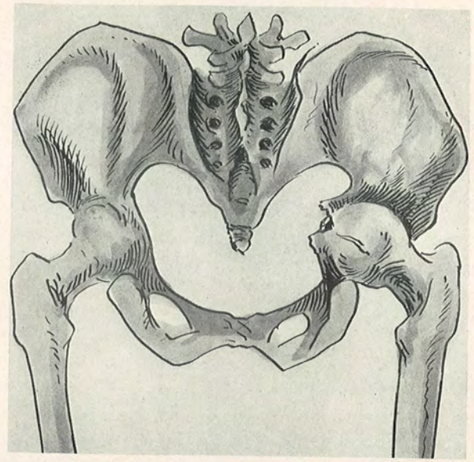
OF PHILADELPHIA.

In dealing with this subject of fracture of the floor of the acetabulum, we shall first present four cases observed by us, then consider the cases hitherto reported in the literature, and finally discuss the subject in general.

Case I.—G. B., male, age forty-three, coachman, admitted June 7, 1911. Fell eighteen months previous to admission a distance of eighteen feet to pavement, landing on right side on greater trochanter of femur. He was laid up for three months in the British Hospital in Hongkong, where he was treated by massage. Since then he has had a limp, which has been getting worse, as well as pain confined to upper anterior part of right thigh. Examination revealed slight atrophy of muscles in right gluteo-femoral region when compared with those of the left side, with motion slightly painful and limited in all directions, but particularly in abduction. Mensuration from internal malleolus to anterior superior spine 33 inches on both sides. The base of Bryant's triangle was equal on both sides; the greater trochanter did not rise above the Roser-Nélaton line on either side; and two lines drawn, one between the anterior superior spines and the other between the tips of the greater trochanters, were parallel. Therefore, there was no demonstrable shortening. Measurements from middle of symphysis pubis to greater trochanters equal on both sides. Therefore, there was no inward displacement of greater trochanter. Rectal examination revealed inward bulging of floor of acetabulum on injured side, but none on opposite side. The skiagram, a diagrammatic sketch of which is shown in Fig. 1, showed inward, tent-like bulging of the middle of the floor of the acetabulum, in keeping with the rectal findings on palpation. In view of the age of the injury (18 months) and the trifling degree of damage to the pelvis, no measures were indicated other than massage and passive motions, which were employed with some benefit until the patient left town.

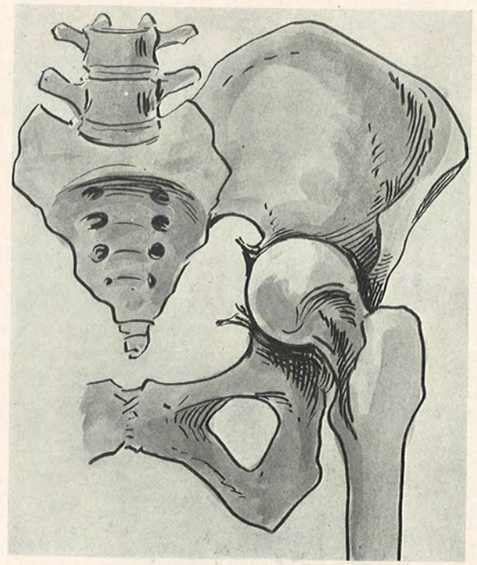
Case II.—J. K., male, age fifty-three, plasterer, admitted

Fig. 1.



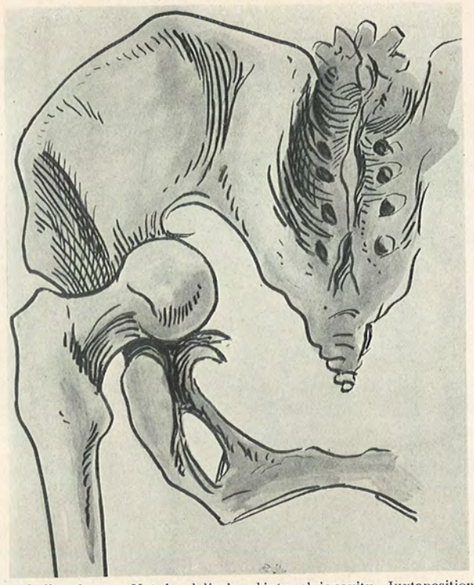
Fractura acetabuli perforans. Note stoving-in of floor of acetabulum, right side. Approximation of greater trochanter to ilium. Posterior view. Sketch from Röntgen plate. (Case I.)

Fig. 2.



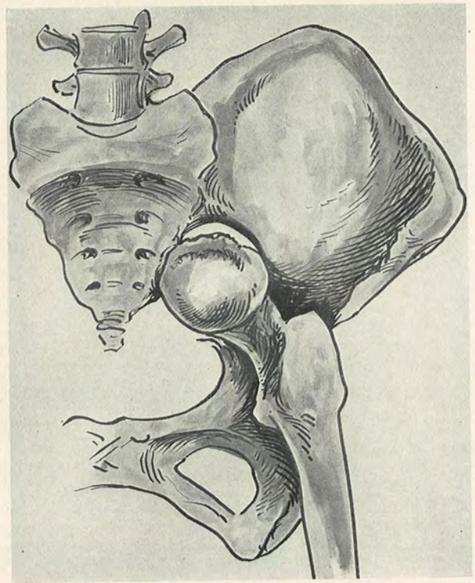
Fractura acetabuli perforata. Note head displaced into pelvic cavity. Juxtaposition of greater trochanter and ilium. Left side, anterior view. Sketch from Röntgen plate. (Case III.)

FIG. 3.



Fractura acetabuli perforata. Note head displaced into pelvic cavity. Juxtaposition of greater trochanter and ilium. Left side, posterior view. Sketch from Röntgen plate. (Case III.)

FIG. 4.



Fractura acetabuli perforata. Note head in contact with sacrum and entrance of greater trochanter into pelvic cavity. Left side, anterior view. Sketch from Röntgen plate. (Case IV.)

October 9, 1911, to service of Dr. John B. Deaver. He had fallen from a height of 20 feet, to the ground, from a scaffold upon which he had been working, striking on the left buttock. Thereafter he could not move, and was admitted to the hospital complaining of disability and pain in hips.

He was immediately catheterized, and ten ounces of clear urine were withdrawn. Further examination revealed a large contusion with ecchymosis upon the left buttock. Pressure upon the pelvis from side to side gave sharp pain in right groin. No crepitus; no dulness in flanks. Rectal examination revealed slight bulging inward of left pelvic wall.

Skiagram showed (1) inward depression of floor of acetabulum (fractura acetabuli perforans) left side, quite identical with the damage shown in Fig. 1; (2) fracture of pubis, horizontal ramus, right side. This lesion was about an inch from the symphysis, and probably resulted from "contre coup." It accounted for the sharp pain in the right groin referred to above.

CASE III.—G. S., male, age thirty-one, admitted January 5, 1904. Fell on left hip 2½ years previous to admission. Complete history not obtainable. Skiagram shows fracture of floor of left acetabulum with head of femur displaced into pelvic cavity (Figs. 2 and 3).

CASE IV.—M. P., male, age thirty-one, admitted December 2, 1910. Fell on left hip 11 months previous to admission. Complete history not obtainable. Skiagram revealed fracture of floor of left acetabulum with displacement of femoral head into pelvic cavity (Fig. 4). This skiagram gives the impression that the femoral head is in contact with the sacrum, in which case there must be in addition either a fracture of the tip of the greater trochanter or else of the upper margin of the acetabulum.

The first recorded case of this injury was rather vaguely described by Henry Callisen in 1788 (*Principia systematis. Chirurgiæ hodiernæ*, 1788). Up to 1904 Arregger (*Deutsch. Zeitschr. f. Chirurg.*, 1904, lxxi, 487) collected 23 cases, including one of his own. In 1909 Schroeder (*Quart. Bull. of Northwest. Univ. Med. School,* 1909, xi, 1, p. 9) collected 49 cases, including three of his own. Somewhat later in 1909 A. E. Halstead added two cases, one his own, bringing the number up to 51. Our four patients make a total of 55 cases reported over a period of 123 years, thus emphasizing the relative rarity of this injury.

Nomenclature.—The Germans refer to this injury as central luxation of the femur (Zentrale Luxation des Schenkelkopfes), thus giving but secondary consideration to the fracture of the acetabulum. Analogous to this is the so-called central dislocation of the jaw, in which the condyle of the mandible is driven through the glenoid fossa at the base of the skull. English authors usually write under the title "Fracture of Acetabulum with Displacement of Head of Femur into Pelvic Cavity" or "Perforation of the Acetabulum by the Head of the Femur." None of these terms appears to us to be sufficiently comprehensive. In the first instance a moment's thought is convincing that we are not dealing with a dislocation in the accepted sense of the term. Holmes defines a traumatic dislocation as "a forcible separation of the articular surfaces of two or more bones, effected by the rupture or stretching of their ligaments." In our injury the floor of the acetabulum is not necessarily separated from the femoral head, and, furthermore, the capsule of the joint is neither torn nor stretched, but, on the contrary, it is made lax and telescoped on itself. Therefore, we have to deal with a displacement, rather than with a dislocation. Again, the injury varies from a slight depression of the floor of the acetabulum, as in Case I, to the passage of the femoral head into the pelvic cavity, as in Cases III and IV. After all, the extent of injury is only a question of the degree of the vulnerating force plus the strength of the bone. For the injury illustrated by our Case I we suggest the term "fractura acetabuli perforans," which implies that the head of the femur started to perforate the acetabular floor but that the vulnerating force expired before the act was completed. For cases where the head of the femur is displaced into the pelvis, we suggest the term "fractura acetabuli perforata," which implies completion of the act and therefore the presence of the displaced head in the pelvic cavity. We believe with the Germans that Latin terminology is not only more exact but also far more expressive.

Etiology.—With but one exception the cause of this injury was indirect violence, most of the patients having fallen a considerable height and landed on the ground upon the

greater trochanter. Others have been struck upon the greater trochanter by a heavy object.

Mechanism.—In falls from a height the acetabulum is passively broken, just as a loose hammer-head is forced upon its handle by pounding the latter upon the floor. When struck by a heavy object, on the contrary, the acetabulum is actively broken by the wedge-like action of the femoral head. The question naturally arises in your minds, when, given a certain vulnerating force, does the acetabulum yield to fracture and when the neck of the femur? While it is difficult to answer, yet several theories suggest themselves. In the first instance, in these injuries the femur has usually been slightly adducted, the force acting upon the greater trochanter in the continuation of the long axis of the femoral neck and head. The cancellous tissue in the head and neck of the femur is arranged as pressure and tension lamellæ, which spring from the inner and outer walls so as to form Gothic arches. It seems plausible, therefore, that these arches would yield least to force applied in the direction of the long axis of the head and neck, so that the force would expend itself upon the pelvis. In our injury the floor of the acetabulum, notoriously a weak place because of its thinness in all ages and of the meeting here in childhood of its three constituent bones, now fractures more or less extensively. If the force strikes the neck of the femur aslant these Gothic arches, however, fracture of the neck may sooner ensue. Variations in the angle of the neck with the shaft, in forward inclination of the neck, as well as in the index of the neck may also act as determining factors in the fracture of one or other bone. But few of the patients were superannuated, and therefore but few of the femoral necks were weakened by the osteoporosis incident to senescence. From this we might conclude that when the neck of the femur is healthy and squarely set, so to speak, it withstands this particular force more stoutly than the floor of the acetabulum. Examination of the macerated innominate bone shows that the non-articular part of the acetabulum is thin enough to transmit light. The area in relation with the articular part of the acetabulum forms an apparently strong and stout buttress, but the thickness here consists solely in two

thin shells of compact tissue between which is sandwiched a large amount of fragile cancellous tissue. Thus it is probable that many of the fractures of the acetabulum are of the variety known as "compression-fractures." As in the skull, the inner shell of compact bone would fracture more extensively than the outer. After removal of the acetabulum, it will be found that the head of the femur can penetrate into the pelvic cavity only about 3 cm., when the greater trochanter impinges upon the ilium. Fracture of the tip of the greater trochanter, however, or of the ilium would permit the head to extend further into the pelvis.

Symptoms.—The symptoms vary naturally according to whether the fracture is perforating or has perforated. The subjective symptoms are pain on motion, localized tenderness, and disability, plus those of whatever complications may exist. Given a macerated pelvis, the objective signs and complications are as easy to read as the handwriting upon the wall. There will be more or less approximation of the trochanter to the symphysis pubis along Morris's line and rectal or vaginal palpation of the stove-in acetabular floor or displaced femoral head. These two signs in conjunction with a good skiagram suffice for diagnosis. There are other signs less distinctive because common to other injuries in this region.

Differential Diagnosis.—In our opinion the most important differential diagnosis is from contusion of the hip. Far more lives will be saved by the correct diagnosis of contusion of the hip than will be lost by overlooking a more patent injury, such as Malgaigne's double vertical fracture of the ilium behind and the pubis and ischium before. The diagnosis of contusion of the hip is really very creditable when correct, for it very properly implies deductions based upon a most careful and painstaking process of exclusion.

Complications.—The complications of this injury but reflect the regional anatomy of the pelvis, and depend upon the extent of the fracture and the shape and character of the fragments. Hæmatomata formed very frequently in the reported cases, due to laceration by a sharp fragment either of

small vessels or of large ones, even the external iliac vein. If the peritoneum is likewise torn, the blood enters the peritoneal cavity as free fluid, instead of forming an extensive retroperitoneal hæmatoma. The obturator nerve, situated in the path of the fragments, is apt to be bruised, lacerated, or severed. Laceration of bowel or bladder is quite within the realms of possibility. The urethra ordinarily escapes because remote, while to reach the ureter a fragment must pass through the thick iliopsoas. The frequency of complications will be lowered in direct proportion to the care and gentleness with which the examination is conducted.

Prognosis.—In the absence of complications the prognosis is good. Stiffness, lameness, and disability of the hip-joint are liable to persist temporarily.

Treatment.—Given a patient with a fresh injury to the hip, we would ignore absolutely any academic paring of the diagnosis until we had satisfied ourselves that the bladder was not ruptured, that the intestines had not been harmed, and that no dangerous hemorrhage was in progress. Now with conscience free to act we would reduce the fracture, put the patient at rest in bed, and apply extension in the axis of the limb in conjunction with lateral traction upon the femoral neck. After a few days, if all goes well, we would apply a gypsum case from the roots of the toes to the costal margin. Having obtained satisfactory union, we would combat the effects of prolonged immobilization of the hip-joint by massage and judicious passive motion.

For the privilege of reporting these four cases we are indebted to Drs. J. William White, John B. Deaver, Charles H. Frazier, and B. A. Thomas, in whose services at the University Hospital they occurred.

Dr. Astley P. C. Ashhurst said that in a recent paper on this subject by Henschen, in which 139 cases were collected, it was said that no attempt should be made to reduce the intrapelvic spicules of bone until the femoral head had been withdrawn from the pelvis; Henschen advised that the thigh be dressed in flexion and adduction in a plaster case, and that the patient should bear no weight on the limb for two or three months.

FRACTURE OF THE SESAMOID BONES

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It is of course common knowledge that the patella is a sesamoid bone and that it is frequently fractured. There does not exist, however, a definite understanding of the fact that the other sesamoid bones may also be fractured; in none of the standard systems or text-books of surgery, nor in the monographs on fractures is there any mention of this condition.

The sesamoid bones are so named from their resemblance in size and shape to the grain sesamum. They are constantly present in the thumb and great toe. In 1892 Pfitzner [1] from an examination of macerated preparations—388 of the hand and 385 of the foot—found that sesamoid bones were present on the ulnar side of the fifth finger in 82.5 per cent., on the radial side of the index-finger in 48.7 per cent., and occasionally on the radial side of the third and fifth fingers. Fawcett [2] in 1897 made the first X-ray study of these bones and found sesamoids in the little finger in 71 per cent. and in the index-finger in 55.2 per cent., in an examination of 38 pairs of hands. Pfitzner found a sesamoid at the interphalangeal joint of the thumb in 69.3 per cent. and Fawcett in 68.5 per cent.

In the feet the sesamoids were found by Pfitzner to occur on the fibular side of the fifth toe in 6.2 per cent., on the tibial side of the fifth in 5.5 per cent., and on the tibial side of the second in 1.8 per cent. of times.

In 1904 Stieda [3] observed two sesamoid bones on the plantar aspect of the interphalangeal joint of the great toe, a tibial sesamoid of the fourth toe and an X-ray showing 9 sesamoids in the five fingers of the hand. He also made the important observation, later confirmed by Dwight,[4] that

there might exist an anomalous division of the sesamoid into two parts, a condition easily mistaken for fracture. In 1907 Momburg [5] reported the instances of two soldiers who injured their feet while jumping from a springing board. The area of tenderness and the X-ray led to a diagnosis of fracture of the sesamoid, but upon X-ray examination of the well feet a similar division of the sesamoid was found. Momburg also records that an examination of his X-ray records reveals 9 instances of a division of the tibial sesamoid, in 3 the bone was in 3 pieces and in 1 in 4 pieces. In 6 the division occurred in both feet. In a second paper Stieda [6] pictures the rare interphalangeal sesamoid of the index-finger, a third or accessory sesamoid at the metacarpophalangeal joint of the great toe and a curious instance of a sesamoid at the web between the great and second toes.

In 1904 Wolff [7] reported 3 instances of a sesamoid in the tendon of the gastrocnemius; in 1909 Pancoast [8] wrote a complete paper on this sesamoid and stated that in about 12.5 per cent. of persons there is a sesamoid in the tendon of the outer head of the gastrocnemius. He calls attention to the possibility of mistaking it for a loose or foreign body in the popliteal bursa.

Dwight notes the frequent occurrence of an isolated bone in the tendon of the tibialis posticus; he terms it the *tibiale externum,* a true part of the skeleton, being found in many mammals and being cartilaginous in the second month of the embryo. In 10 per cent. of persons it is a separate bone; in the remainder it is part of the tuberosity of the scaphoid. Painter [9] reports a sprain-fracture of the tibialis posticus tendon in which operation revealed the isolated bone, the size of a lima bean, seeming to have a false joint between it and the body of the scaphoid.

The sesamoid bones are developed from cartilage and first make their appearance as osseous structures in the toe about the eleventh year, the others a year or two later. They are usually met with in the substance of tendons and in the neighborhood of joints. One surface is usually covered with

cartilage and either enters into the formation of the joint or, separated from it by a bursa, plays on another bone, or on cartilage or ligament. This function is to obviate friction or to change the direction or pull of a muscle. They are to be considered as parts of the skeleton all of which have their places in certain animals, but all of which either are not developed, or if they do appear are again lost in others. Thus, certain sesamoid bones of the finger are frequent in the fœtus and rare in the adult (Piersol). The feet of the armadillo and the forefeet of the mole are provided with many sesamoids; in the horse one of the sesamoids is termed the navicular.

The constant sesamoids of the thumb are two in number, situated on either side of the middle line at the metacarpo-phalangeal joint. They are connected by a strong fibrous band which forms the floor of the groove for the long flexor tendon. Anteriorly they give attachment to the short muscles of the thumb, and posteriorly are smooth. The lateral ligaments of the joint are partly inserted into their sides.

Fracture of these sesamoids seems to have been observed but twice. In 1907 Preiser[10] reported the instance of a woman, 30 years of age, who fell on the right hand and broke both of the sesamoids of the thumb, and in 1909 Morian[11] observed a fracture of the ulnar sesamoids in a girl age 27, who had caught the thumb in a closing door.

The constant sesamoids of the great toe are developed in the tendon of the flexor brevis hallucis and play in a groove on the head of the metatarsal. They are united to both phalanx and metatarsal by stout fibres and laterally are connected with the lateral ligaments of the joint and the sheath of the flexor tendons.

The first instance of fracture of these bones was reported by Schunke[12] in 1901; Marx,[13] Muskat,[14] Momburg,[5] Igelstein,[15] Stumme,[16] Morian,[11] and Painter[9] have also reported cases. Of the 16 cases reported, including my own, 14 were in males, one in a female and one not stated; the ages ranged from 14 to 66 and averaged 37 in twelve where the age was

given. Nine occurred in the right foot, 6 in the left. The external or fibular sesamoid was fractured in 1 case, the tibial sesamoid in 9 and in 5 there was a division in the sesamoids of both toes although only one side had been injured. On account of the finding of a division on both sides Momburg doubts the authenticity of the fractures he reports and both Igelstein and Painter are inclined to do likewise of theirs. That fracture is possible has been proven by the pieces excised and by the experiments of Stumme on the cadaver. He proved that forcible dorsiflexion with abduction may fracture the tibial sesamoid. He also believes that we can differentiate a fracture from an anomalous division: by the sharp edge of the line of fracture, by the oval shape of the fragments in the anomalous division, by the history of the case and a normal other toe. The character of injury in the reported cases is variously given as being due to sudden falls on the feet and the dropping of heavy weights on the toe. In 3 of the cases operative treatment was practised, the remainder being treated by plaster of Paris and supports.

I have observed the following case:

A woman, age 35, was injured two years ago by having the foot trod on while dancing. The acute symptoms soon disappeared, but there remained a residual soreness and pain on walking. Examination revealed nothing except slight tenderness over the site of the sesamoid bones of the left great toe. An X-ray made by Dr. Pfahler showed a transverse fracture of the tibial sesamoid with slight separation of the fragments, but no displacement. On June 27, 1911, I removed the sesamoid through an incision about one-half inch above and parallel to the tendon of the flexor longus hallucis. It was necessary to detach the inner head of the flexor brevis hallucis. The capsule was then cut and the joint opened. After removal of the fractured sesamoid the tendon was sutured to the capsule. The wound was closed without drainage. On October 2, 1911, the patient expressed herself as being entirely relieved of all pain and disability.

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[14] Muskat, Deutsche med. Woch., Jahr 32, s. 1319.
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NOTE.—There are two instances of luxation of the sesamoids on record, viz., Karschulin (Wiener med. Woch., 1906, No. 17, s. 814) and Perlman (Deutsche Militar. Arztl. Zeit., 1904, s. 474).

STATED MEETING, HELD DECEMBER 4, 1911

DR. R. G. LE CONTE, President, in the Chair.

A CHILD WITH RUDIMENTARY LEFT UPPER EXTREMITY (PEROBRACHIUM).

DR. PENN G. SKILLERN, JR., exhibited the patient. He was a male, aged 5 years, the second youngest child of healthy and normal Irish parents. Five brothers and sisters healthy and well formed. Patient presents no other abnormalities or defects, congenital or acquired.

As shown by the sketch (Fig. 1), the left upper extremity is very rudimentary, extending but little more than half way down the chest wall, to which it is adherent, instead of down nearly to the left knee. The limb terminates in a free foot-shaped projection, of which the heel corresponds to a rudimentary thumb and the remainder to a partially flexed and fairly well-developed index-finger.

Movements of the limb are principally elevation of the shoulder and flexion of the remaining dwarfed segments.

External examination reveals a fairly well-developed clavicle, an acromion, a very small humerus, an elbow-joint, small forearm bones, and in the index small nodules of bone corresponding to a carpal, a metacarpal, and a phalanx. The presence of the elbow-joint was confirmed by Dr. Astley P. C. Ashhurst.

Internal examination by Röntgen rays served to orientate the skeleton of the limb more accurately. The first skiagram taken (Fig. 2) shows a comparatively well-developed clavicle, a rudimentary acromion, coracoid process, humerus, forearm, carpal, and digit bones. As it was afterward determined, the scapular spine was obscured in this picture by the shadow of the clavicle. Because the glenoid rim and elbow-joint were not well shown, another skiagram was taken (Fig. 3). Now the upper extremity of the humerus was found in juxtaposition with a rudimentary glenoid, from which there faded away below an indistinct axillary border. The scapular spine is now shown. The position of the elbow-joint is brought out by the partially flexed forearm. The radius and ulna here form a common shadow.

Epiphyses are lacking, and the bones have advanced but little in development beyond a stage represented by the early months of intra-uterine life.