When the diagnosis between inguinal and femoral hernia is difficult, a femoral hernia will probably be present.

All femoral herniæ should be considered dangerous because intestine may escape on any severe strain and cause strangulation. For this reason it is safer to operate on all femoral herniæ before strangulation than to take the chances of strangulation.

The hernia is subcutaneous, no muscles are divided, and the peritoneal cavity is barely opened. Simple removal of the sac will probably cure in the great majority of cases, but the approximation of Poupart's ligament to the pectineal muscle and fascia by one or two catgut sutures will add to the certainty of cure.

The vertical has advantages over the transverse incision, and the removal of a thick layer of the fat adherent to the sac favors the easier exposure and suture of the ring.

The closure of the ring by the external exposure and suture is safer, easier and more effective than by the internal exposure through the inguinal canal.

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STATED MEETING, HELD OCTOBER 4, 1915

The President, Dr. John H. Gibbon, in the Chair

FRACTURE OF THE OS CALCIS

Dr. Nathaniel Ginsburg related the details of four cases of fracture of the os calcis. The first two of these were observed and treated by him through the courtesy of Dr. Edward Martin. Their histories are as follows:

Case I.—Case No. 10468. M. I., male, was admitted to the Mt. Sinai Hospital on April 4, 1915, and discharged on May 20, 1915. He had jumped out of a second-story window to escape from a fire, and landed on the heel bones of both feet. He was immediately brought to the hospital, unable to stand, with severe pain, swelling, and discoloration of the entire posterior portion of the foot and lower leg. X-ray showed present fracture of both ossa calcis. The patient remained in the hospital about six weeks and was finally discharged able to go about on a cane and crutch. He died six weeks ago of heart disease.

Case II.—Case No. 10690. A. M., male, was admitted to Mt. Sinai Hospital on April 18, 1915, and discharged May 27, 1915. He fell from a step-ladder, alighting on the heel-bone of the right foot, and sustained a fracture of the os calcis. He now walks with a cane and has pain on the outer side of the foot below the external malleolus.

Case III.—Female, aged thirty-five years, was admitted to Dr. Ginsburg's service at the Jewish Hospital, June 22, 1915, having fallen through a skylight to the floor below, landing upon both feet. She sustained a fracture of the left os calcis and a transverse fracture of the internal and external malleoli of the left tibia and fibula without separation of the latter fragments. In addition she sustained a fracture of the external tuberosity of the right tibia, the line of fracture running into the knee-joint, and a fracture of the adjacent head of the fibula with some impaction. This type of fracture of the tibia in this region is of rare occurrence. The patient was put to bed with moderate extension by traction apparatus on the right leg, not sufficient, however, to separate the fragments but merely to prevent contact of the knee-joint surfaces.

The displacement of the os calcis was regarded as one which could not be markedly improved by operation or by much manipulation, and the foot and leg were put at rest in a fracture box

and an ice-bag was applied to the seat of fracture, and after much of the swelling had subsided a light plaster case was applied enclosing the foot and leg. The fracture of the os calcis was of the comminuted type, involving the anterior extremity of the bone with some cortical tearing of the posterior plantar portion.

CASE IV.—Male, admitted to Dr. Ginsburg's service at the Jewish Hospital June 24, 1915, and discharged August 8, 1915. This patient fell down a casement and was admitted to the hospital suffering from fractures of the left humeral anatomical neck and a T-fracture of the left radius at the wrist-joint. The latter fracture showed some impaction and was apparently accompanied by a fracture of the styloid process of the ulna.

Under ether anæsthesia abduction and extension of the humerus at right angles to the body was maintained by a plaster case enclosing the thorax and the arm. The extension was maintained in bed by a traction apparatus similar to that applied in treating a fracture of the femur. A radiographic examination showed little improvement in the position of the fragments, the head of the humerus being elevated and rotated outward and the lower fragment being drawn upward and inward into a high axillary position. The plaster case was removed, the arm dressed to the side of the chest wall with a high axillary pad and a weight extension from the elbow. Good union in good position resulted, the movements of the shoulder-joint being excellent. The impaction of the lower end of the radius was broken up and a light plaster case applied, succeeding a Bond splint which was primarily employed. There is now little anatomical deformity and practically normal function of the hand.

Dr. Ginsburg remarked in connection with these cases that fracture of the os calcis is regarded by Cotton as being the commonest injury (fracture) of the tarsus. Three types of this fracture are commonly observed: (1) one being a fracture of the bone at the osseous attachment of the Achilles tendon; (2) a second type is a simple fracture of the sustentaculum tali; (3) and a third type, one which he had had the opportunity to observe in a number of patients, is a comminuted fracture of the body of the bone due to a compression force sustained by falling or jumping from a height and landing on one or both heels. This latter type is the one observed with greatest frequency. The disability resulting from fracture of the os calcis, especially of the comminuted type, is unquestionably a very severe and lasting one; in many instances the bony contour of the foot being so seriously disturbed as to permanently disable the patient. In this type of fracture of the body of the os calcis the molecular disintegration takes place approximately

near a vertical line just in front of or through the posterior articulation between the astragalus and the os calcis. The comminution of the bone may be severe enough to result in a few fragments or in almost total disintegration of the body of the bone in the region injured. The lines of fracture may have a stellate appearance running off in various directions. The displacement resulting from a comminuted fracture about the middle of the os calcis, or anterior to a vertical line drawn through the middle of this bone, is apparently the result of the dropping down of the inner border of the foot, owing to the lack of bony support at this point, and also due to some "diminution of the total depth of the bone," especially of its forward end (Cotton). Should the displacement of fragments resulting from a fracture result in an irregular contour of the plantar surface of the os calcis, a painful foot will result, simulating the condition found in exostoses of the os calcis from other causes.

A fracture of the contiguous dorso-inferior articular portion of the scaphoid bone may result, if the compression force sustained producing the fracture is partly borne by this bone.

The diagnosis of this fracture can be made in most cases by a history of the accident sustained, which is usually a fall or a jump from a height, the patient landing on the feet. Much swelling and some distortion of the normal outlines of the foot in this region promptly take place. The swelling is often so marked, and manipulation is accompanied by so much pain that it is hardly justifiable to attempt a diagnosis by examining for mobility or eliciting crepitus of the fragmented bone. The radiologic examination is the important one both for diagnostic and prognostic value.

The immediate and diffuse swelling, accompanied by much pain and tenderness, is so marked that little can be done except to put the foot at absolute rest in a fracture box with an ice-bag or sedative lotion applied to the part. From radiographic study of the injury it can be determined if improvement in the position of the fragments is possible by the employment of an anæsthetic. If, however, the bony outlines are fairly well preserved, union will take place with a resultant good position of the heel, but with some tendency toward dropping of the inner posterior aspect of the foot. If indicated, tenotomy of the Achilles tendon should be done early to assist in mobilizing the posterior fragment in order to reëstablish the morphological outline of the bone.

DR. JAMES K. YOUNG said that this fracture is more common than is usually supposed. It is apt to occur when a person falls from a height and lights on his feet. One might expect it to occur from lateral crushing, as when a horse rolls on a rider's foot. In such accidents,

however, and in automobile collisions the astragalus is more apt to be the bone fractured. He had seen a number of these cases several weeks after the injury and suggested more through treatment at the time of the injury in order to avoid the subsequent flat-foot and deformity of the ankle. Under an anæsthetic reduction should be made promptly by reimpaction of the fragments, with the hands or with a mallet and sandbag, after the method of Cotton. After the reduction, one felt pad should be placed over the dorsum, one over the os calcis and tendo Achillis, and one under the plantar arch, and, with plantar flexion of the foot and flexion of the knee, the foot and leg to the upper third of the thigh should be placed in a plaster-of-Paris cast for two weeks, after which manipulation and other remedial measures should be used.

T-FRACTURE OF THE LOWER EXTREMITY OF THE RADIUS

Dr. H. A. McKnight (by invitation) presented a man forty-six years of age, whom he had seen in Dr. Booth Miller's clinic at the Polyclinic Hospital. The man, August 18, 1915, fell eight feet from a ladder, landing on his side and left arm, and in falling jammed his left closed fist against an iron beam; on recovering from the effects of his fall he noticed soreness and slight swelling of his left wrist.

Six days later the reporter saw him; he still complained of soreness and pain on motion. Examination showed increase in the anteroposterior diameter of the wrist, although this thickening was an uncertain diagnostic sign, as he had broken the other arm twice before, so no comparison could be made. The styloid processes were in proper alignment, but wincing tenderness was elicited along the radial shaft and on extreme abduction over the ulnar styloid.

The X-ray revealed (Figs. 1 and 2) an impacted fracture of the lower end of the radius with two linear splits extending upward for about one and one-half inches and nearly parallel with each other, being separated by an interval of a quarter of an inch below and one-eighth above, thus converging from below upward, a fracture of the ulnar styloid and a slight posterior displacement of the distal radial fragment. The skiagram shows complete impaction of the radial fragments which to a casual observer would present no abnormality, but the lateral view (Fig. 2) shows the line of the radiocarpal articulation tilted backward instead of facing slightly forward as it does normally. The impacted fragments were separated under gas, and the arm splinted with a Bond and a posterior straight splint.

Skiagrams taken two days later (Figs. 3 and 4) show the arm after

Fig. 1.

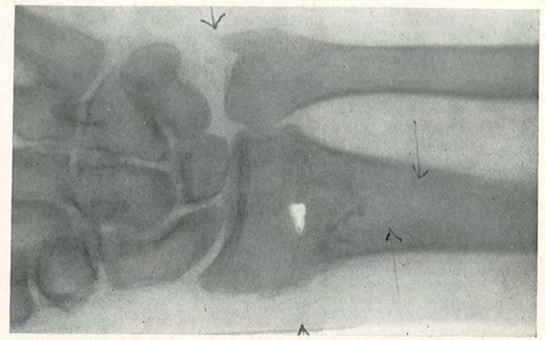
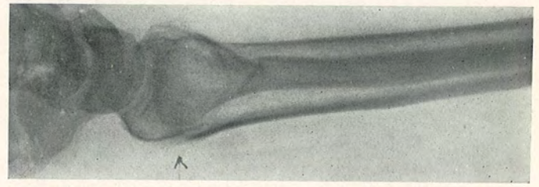


Fig. 2.



Figs. 1 and 2.—Impacted fracture of lower end of radius with linear splitting.

FIG. 3.

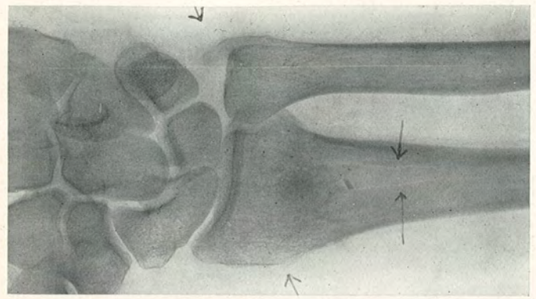
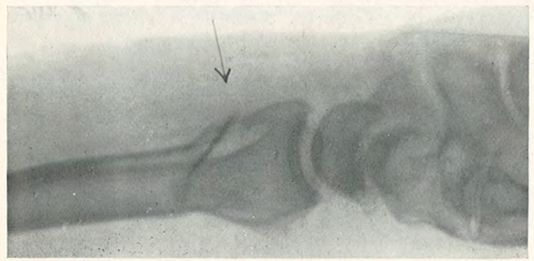


FIG. 4.



FIGS. 3 and 4.—Fracture shown in Figs. 1 and 2, after reduction.

reduction; the transverse fracture is more distinctly shown, although the linear cracks are not so easily seen. The radiocarpal joint line is now normal and faces slightly forward instead of backward.

Dr. McKnight added that uncomplicated longitudinal fractures in this position are rare, only nine cases having been reported, and he had found none in which an impacted Colles's fracture was also present.

Bigelow in 1858 reported a stellate fracture of the lower end of the radius extending along the shaft, and Cotton in 1910 stated that, "So far as we know this fracture is the result of direct violence by crushing. It is rare, three specimens constitute the total of evidence." Since then Parrish, Bendell Wilhoit and Skillern have presented fractures of the radius, and Dr. Miller has seen one case caused by the direct violence of a window falling on the wrist.

The clinical diagnosis is difficult and has only been made heretofore by means of the X-ray, although the symptoms in the cases reported present marked similarity. There is usually a history of direct violence; clinical examination reveals slight swelling and tenderness along the line of the shaft, but no deformity. Treves reports a case in which he claims he felt a vertical linear ridge but was unable to make a definite diagnosis without the X-ray which showed a longitudinal fracture extending upward for about two inches.

In cases of direct violence due to direct force in the line of splitting the mechanism is simple. The scaphoid and semilunar are driven upward and outward by the upper end of the os magnum, causing a cross strain against the lower articulating end of the radius with resulting split. The further complication of a fractured ulnar styloid is not unusual, as 66 per cent. of fractures of the radius are complicated by this added fracture.

This case is of interest due to its rarity. The diagnosis in uncomplicated cases may be suspected clinically by analysis of the history plus a vertical linear area of wincing tenderness.

DR. JOHN B. ROBERTS showed two skiagraphs of a recent fracture of the lower end of the radius. They show a splitting off of a portion of the posterior lip of the articular surface very much in the direction described by John Rhea Barton. A good many medical men confuse the various fractures at the base of the radius with that described by Colles of Dublin, which he considered to be an injury occurring about an inch and a half above the joint. It would be better to call a fracture at this point a break in the lower fifth of the shaft. The displacement is usually backward, but may be reversed so that the upper end of the lower fragment is directed forward. Almost all physicians give the

name of Colles to all fractures of the lower end of the bone, whether they be at the point described by him, or the so-called classic fracture through the base of the radius with backward displacement. The latter was considered up to the time of Dupuytren a probable posterior dislocation of the carpus. Both the classic fracture and the true Colles's fracture have usually a backward displacement of the upper end of the lower fragment, but both of them may be reversed, the lower fragment being displaced backward at its lower end.

BONE TRANSPLANTATION

That no two fractures can be treated alike is a certainty. Each fracture is treated according to the individual status of that special case. Every Colles's fracture cannot be treated on a Bond splint, a Levis splint, a Palmer splint, a posterior splint, between two splints, or in a cast. Nor can every Pott's fracture be treated in a fracture box, on Dupuytren's splint, or in a cast. The treatment of each is adapted for the individual case. The same is true of the open treatment of fractures. Lane's plates, silver wire, catgut mesh, Parkhill's clamps, bone transplants, etc., each has its own advantages or disadvantages, and no one method can be used in every case.

In two of the cases cited below it was necessary to digress from the usual method of treatment. The principle of each seems sound.

Dr. Hubley Owen related two cases of fracture in which bone transplantation was employed in their treatment.

Case I.—Miss S., aged twenty-six, fell downstairs on October 21, 1914, and sustained a dislocation of her left elbow, and a fracture of the lower third of the radius of the same arm. She was treated by her family physician and subsequently returned to her occupation, that of a stenographer, at the end of five weeks. Because of stiffness of her elbow and inability to properly supinate her left hand in order to typewrite, she was referred to reporter in January, 1915.

An X-ray was taken at that time, and showed an unreduced dislocation of the head of the radius and a fracture of the lower third of the radius, with vicious union. The lower fragment was displaced upward and inward, and was united to the upper fragment and to the ulna. Supination and pronation were impossible.

On January 24, 1915, he removed the head of the radius, and attempted to correct the deformity of the broken radius. After he had separated the two fragments, and had also separated the lower fragment from the ulna, and straightened the wrist, he found that when the fragments of the radius were in alignment

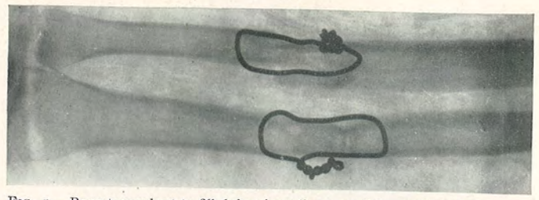


Fig. 5.—Bone transplant to fill defect in radius; condition at time of operation.

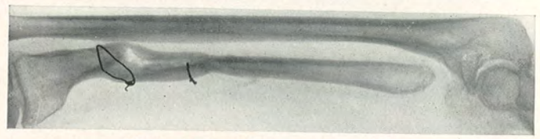


Fig. 6.—Final result of case shown in Fig. 5.

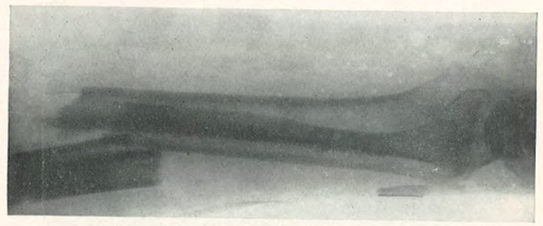


Fig. 7.—Deformity after fracture of forearm.

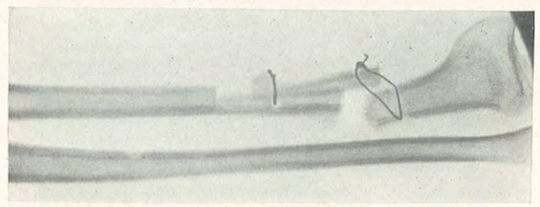


Fig. 8.—Fractured forearm, bone fragments dovetailed and secured by silver wire.

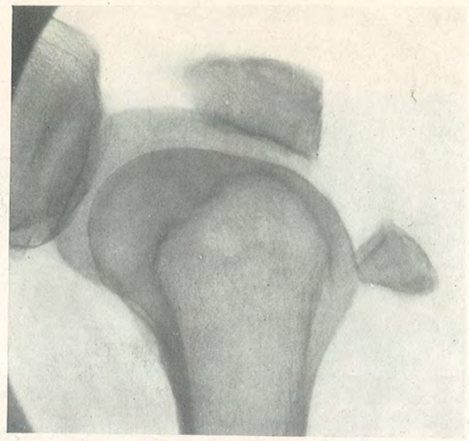


FIG. 10.—Fracture of patella.

FIG. 11.—Result of non-operative treatment.

there was a gap of about an inch between the fragments. A transplant was then taken from the upper fragment, which was one-half the diameter of the bone. He was unable to transplant this into the lower fragment, so, as shown in the X-ray (Fig. 5), the transplant was merely laid alongside the two fragments and wired thereto. The second X-ray (Fig. 6) shows union of the two fragments.

The excision of the head of the radius gave her good motion in her elbow, and she now has good pronation and supination of her forearm.

There is some eversion of the hand, which can be corrected by the excision of a small part of the shaft of the ulna.

CASE II.—J. D., aged fifty-six, tripped and fell downstairs in July, 1915, and sustained a fracture of both bones of the left fore-

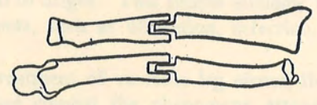


FIG. 9.—Diagram showing method of dovetailing bone fragments together.

arm. He was admitted to the Philadelphia Hospital three days after his injury, with the deformity as shown in the X-ray (Fig. 7). Two attempts were made to reduce the fracture with an anæsthetic. Both attempts were unsuccessful. Traction was then tried, but also failed.

He was operated upon August 10, 1915, and the attempt was made to hold the bones in alignment by dovetailing the ends of the fragments into each other. With a Gigli saw an oblong piece of bone was cut from the lower fragment, and, with the same implement, the upper fragment was cut so that it would fit into the groove of the lower fragment. He then supplemented this by silver wire, as shown in the X-ray (Fig. 8). The bones are uniting nicely.

Fig. 9 shows the manner in which the fragments were cut.

CASE III.—H. P., aged forty-six, fireman by occupation, fell in July, 1905, on his right knee, and sustained a fractured patella. He was treated at the Pennsylvania Hospital. He was not operated upon, but the fragments were held together by means of adhesive plaster. At the present time he has fibrous union (Fig. 11) but has absolutely good function of his knee.

In November, 1913, while working at a fire, he fell and sustained a fracture of the left patella. He was operated upon at the Jefferson Hospital, and the patella was wired.

He again fell, September 26, 1914, broke the silver wire and refractured his patella. The case was in the service of Dr. J. Chalmers DaCosta, who advised against another operation.

X-ray plate (Fig. 10) shows the wide separation of the fragments of the patella.

By treatment with a brace, which was so constructed that he was given more motion in the knee-joint each week, he now has firm fibrous union (Fig. 11) between the fragments, has discarded the brace and has perfectly good use of his knee.

TREATMENT OF VARICOSE LEG ULCERS*

By Penn G. Skillern, Jr., M.D.
of Philadelphia

Varicose leg ulcers belong to that class of maladies for the cure of which a host of therapeutic measures is recommended. The purpose of this paper is to show both the fallacy and the futility of expecting a cure of varicose leg ulcers by drug therapy alone, and to prove that the most efficient therapeutic measure is the vis medicatrix naturæ.

Varicose veins are a penalty of the upright position. Reduced to its simplest terms, the pathology is primarily that of chronic venous congestion, mechanical in origin. This simple etiologic factor underlies all the secondary effects, such as ulceration, infection, fibrosis and bone involvement.

The rational treatment of varicose leg ulcers, then, must be based upon measures that combat the phenomena attendant upon chronic venous congestion, namely, transudation of serum and migration of blood-cells into the connective-tissue interspaces, and the inevitable fibrotic thickening of the walls of the connective-tissue interspaces.

Reduced to its simplest terms, the rational treatment of varicose leg ulcers, based on their pathology, depends upon the recognition and application of the principles of, first, protection, second, drainage, and, third, support.

(1) *Protection.*—Any ulcer is cured when epithelialization of its entire surface is complete. Epithelialization of the ulcer surface will not occur in the presence of an unhealthy ulcer base. The ulcer base is made healthy by affording drainage of the matter discharged from it and by giving it proper support. With the ulcer properly drained and supported the epithelium at the margin of the ulcer begins to regenerate. Because of its delicacy of texture and superficial position, this regenerating epithelium requires protection, lest it be torn away during the change of dressings. The best protective agent is a material that has a perfectly smooth surface. Such a protective agent is rubber tissue. When the ulcer is large its epithelial edge may be efficiently protected by being covered with strips of rubber tissue cut to about one-fourth inch in width (Fig. 2). When the ulcer is small a piece of rubber tissue may be cut to the size of the ulcer and a hole made in the centre of the

* Read before the Philadelphia Academy of Surgery, October 4, 1915.

piece of tissue to afford an outlet for the discharge from the ulcer into the superposed dressing. If no outlet be provided, this discharge accumulates beneath the rubber tissue and most effectively macerates the regenerating epithelial edge. This macerating action constitutes a valid objection to the no-drainage method of smothering the ulcer with an impervious unguent dressing.

(2) *Drainage.*—As just stated, provision for the escape of the discharge from the ulcer is made by cutting a hole in the centre of the piece of protective rubber tissue. The amount of discharge will lessen as the œdema of the tissues subsides from the pressure of the bandage.

What is the best form of dressing to take up the discharge from the ulcer? The tissues are already more or less water-logged, so why apply a wet dressing? A wet dressing does not remain wet very long unless evaporation of its contained fluid be prevented by such an impervious material as paraffin paper or oiled silk. But a wet dressing covered by an impervious material merely increases the maceration of the already macerated tissues, and, furthermore, it is impracticable for the patient to keep the leg dressing moist until the time of the next visit.

Plain, dry, sterile gauze admirably meets the requirements of a dressing that will take up the discharge without increasing the water-content of the tissues. It may be objected that dry gauze placed in direct contact with a granulating surface would act as a mechanical hindrance to the granulations by their becoming adherent to it and growing into it, so that at the change of dressings the granulations would be traumatized by removal of the gauze. Practically, however, the granulations do not become adherent to the gauze owing to the slimy character of the discharge from the ulcer. The only place where the gauze could become adherent is at the epithelial edge of the ulcer, but the epithelial edge is already protected by the rubber tissue. When the dressing is removed it comes away freely without sticking at any spot.

(3) *Support.*—It is a well-known clinical fact that the very best treatment of varicose leg ulcers is by the non-ambulatory method, of rest in bed with elevation of the limb involved. The explanation of the superiority of the method of rest in bed with elevation is, of course, that the chief etiologic factor in the development of varicose veins—the attraction of gravity for the long column of blood in the saphena magna—is overcome; the œdema of the tissues subsides, and with the subsidence of the œdema the nutritional state of the tissues is improved, and improvement of the nutritional state enhances the power of tissue repair. But few patients, however, can afford to take to bed on account

of a leg ulcer. We are forced, therefore, to combine with the ambulatory treatment the advantages of the non-ambulatory.

The best substitute for rest in bed with elevation is support of the limb; the best method of supporting the limb during the active treatment of large or multiple leg ulcers is by the application of a roller bandage, not of gauze, but of muslin; and the best type of bandage to apply is the spica, or figure-of-eight of the leg.

While commonly used, yet gauze bandages do not support the tissues as firmly as muslin bandages support them, and gauze bandages have a tendency to roll up and become disarranged. The spiral reverse bandage of the leg, advocated by some, looks prettier in the text-books than upon a patient's leg. In everyday practice a spiral reverse bandage cannot be applied upon an inverted cone, such as the leg below the calf represents, and be expected to remain in place for forty-eight, or twenty-four, or even six hours, however long the patient may be up and about.

Given one or two ulcers of limited size where healing is delayed by induration at the base and periphery of the ulcer, and provided that the skin is healthy, there is no better method to effect epithelialization than that suggested so long ago as 1792, by Thomas Baynton, of Bristol, namely, firm strapping of the ulcer by imbricated lengths of adhesive plaster applied from below upward and encircling the limb for two-thirds of its circumference (Fig. 1). When treatment was begun upon these ulcers they were indolent and sluggishly inactive, and had been for several weeks. The sketch shows the improvement after a week's strapping: from being indolent and sluggishly inactive the ulcers were transformed into healthy, rapidly epithelializing and granulating wounds, the contrast between the pure blood-red and firm granulations and the broad, bluish-white band of rapidly regenerating epithelium being so striking as to merit reproduction in tints. It is my practice to fill the excavation of the ulcer flush with the skin with a powder before applying the straps of adhesive plaster, and for this purpose I have found calomel the most useful powder. The powder serves as an agent for transmitting the pressure and support of the adhesive straps to the floor of the ulcer; without powder the straps would merely bridge across the excavation of the ulcer.

The striking efficiency of the strapping method is purely in keeping with the old surgical principle that pressure upon tissues promotes absorption of fluids and, later on, atrophy of the tissues themselves. As the induration at the base and edges of the ulcer melts away under the influence of the pressure exerted by the straps, the blood-channels

are opened up, and instead of there being an excess of venous over arterial blood, the proper proportion is restored by the venous blood being permitted egress from the ulcer, and the healing arterial blood ingress into the ulcer.

For the routine treatment of the average varicose leg ulcer nothing serves better—nor is there any more economical form of support—than Unna's zinc oxide and gelatin paste enmeshed in a gauze bandage so as to form a stocking with the consistency of rubber. Upon the patient's return the Unna stocking is fenestrated at the site of the ulcer, as indicated by the area of staining from the discharge. In addition to fenestrating the stocking, it is my practice to cut the edge of the fenestration in a spoke-like manner, to prevent congestion of the ulcer from the edge of the fenestration pressing into the edge of the ulcer. I have seen many ulcers change from a livid to a rosy hue by merely making these spoke-like incisions into the edge of the fenestration. After the ulcer has been uncovered by fenestration of the stocking in this manner, it is treated by the rubber-tissue-dry-gauze-muslin bandage method described above. Unless it become loose, or very much soiled, the Unna stocking need not be changed for three weeks.

After varicose leg ulcers have been cured, it is important immediately to institute prophylactic methods against recurrence; and for this purpose a well-fitting silk-elastic stocking or a Randolph bandage should be used. Patients should be reminded that in the course of time a silk-elastic stocking wears out and loses its power of supporting the tissues, and that for this reason a new stocking must be purchased at intervals.

To prove the efficiency of the purely mechanical *vs.* the medicament treatment of varicose leg ulcers, I decided to put my method to a severe test by selecting the most extensive case of varicose leg ulcer that I could find. Accordingly, three weeks ago, I began treatment upon a patient whose legs were the seat of chronic multiple leg ulcers. This patient, a man aged seventy-five years, had had the ulcerous condition for about a quarter of a century, and during that extent of time recurrences had been numerous. He reported in the Surgical Clinic of Professor Morris Booth Miller, at the Philadelphia Polyclinic Hospital. From being indolent and sluggishly inactive (Fig. 2), now, after only three weeks of mechanical treatment, the bases of the ulcers are covered with healthy, red, vigorous granulations, while the epithelial edges are bluish-white and rapidly regenerating. When ulcers assume these healthy tints they never fail to heal. The complete epithelialization of some of the smaller ulcers indicates that there has already been established

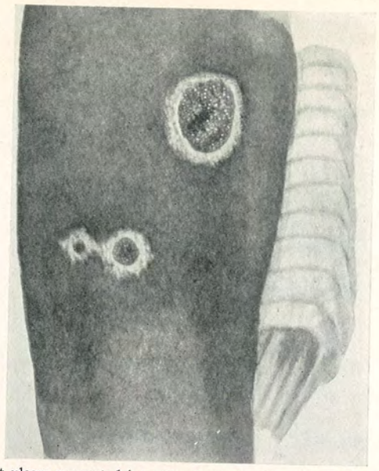


FIG. 1.—Indolent ulcers converted into the classic healing variety by the calomel-adhesive-plaster method. Note firm, bright red granulations and encircling broad band of bluish-white, rapidly regenerating epithelium. Straps curled back for sketch. Author's case (*International Clinics*, 1913, vol. iii, 23d series, p. 210).

FIG. 2.—Photograph of multiple varicose leg ulcers taken at beginning of the mechanical method of treatment. Note protection of epithelial edges by strips of rubber tissue.

a tendency to vigorous healing, and that with time and a little patience, complete epithelialization of the largest ulcer may be predicted with certainty unless the ulcer is adherent to bone.

NOTE (January 12, 1916).—Under the above-described treatment the smaller ulcers healed rapidly so that, the skin now being intact, the calomel-adhesive-plaster method was substituted, with a view to curing the two large ulcers, one on each leg. By this method the amount of discharge rapidly diminished, the ulcers quickly assumed the appearance shown in Fig. 1, and the area occupied by the ulcers became markedly decreased.

At present, owing to the adherence of their base to the bone, these two large ulcers, while healthy, seem to have reached a stationary stage in healing; all that is needed for completion of the process of epithelialization is the stimulus afforded by a few Thiersch grafts, which will be applied forthwith. Were it not for the vigorous granulations already covering the bone, the suggestion of C. H. Mayo ("The Preparation of Dry Bony Areas for Skin Grafting," ANNALS OF SURGERY, September, 1914, p. 372) could well be applied in this case.

For an exhaustive paper on other aspects of varicose leg ulcers, consult article by Williams (*British Medical Journal,* July, 1913).

CONCLUSIONS

1. The rationale of treating varicose leg ulcers is to establish a tendency to heal by combating the pathologic hindrances to healing.

2. The pathologic hindrances to healing are the sequelæ of chronic venous congestion; and chronic venous congestion, in its turn, is the result of the inability of the vena saphena magna and its tributaries to withstand the attraction of gravity upon the long column of blood contained therein.

3. Reduced to its simplest terms, the rational treatment of varicose leg ulcers depends upon the recognition and application of the principles of, first, protection of the regenerating epithelial edge, second, drainage of the discharge from the ulcer and, third, support of the venous channels from without, thus neutralizing the baneful effects of chronic venous congestion.

4. The agents employed in the rational or drugless treatment of varicose leg ulcers may be summarized by terming the method the rubber-tissue-dry-gauze-muslin bandage method. In selected cases the calomel-adhesive-plaster strapping method cures rapidly and efficiently; while for routine treatment of the average case Unna's zinc-oxide-gelatin paste stocking serves as an admirable and efficient support.

5. The tendency to healing has been established when the base of the ulcer is covered with healthy, red, vigorous granulations, and when the epithelial edge becomes broader and assumes a pale, bluish-white tint.

6. If in a case of multiple varicose leg ulcers the smallest ulcers become completely covered with epithelium under the influence of treatment, it has thereby been proven that a tendency to healing has been established, and that in time the larger ulcers will heal, if not too large, excessively fibrosed, or adherent to bone.

7. Healing of the ulcers having been brought about, it remains to prevent recurrences. Recurrences may be prevented by mechanical or operative methods: mechanically, by the use of a silk-elastic stocking, renewed when worn out, or by a Randolph bandage; and barking of the shin should be insured against by a shin-guard or wool padding of that part of the stocking that covers the shin. If an operation for excision of varicose veins augurs favorably, it should be performed after healing of the ulcer has taken place; otherwise, the operative wound might become infected from the ulcer, and septic thrombophlebitis, with all the attendant dangers of embolism, might then ensue.

8. The success of the rational, drugless, or mechanical treatment proves the fallacy, as well as the futility, of expecting cure from the application of medicaments, while overlooking the fundamental pathologic etiology of the ulcer.

9. Fads, such as scarlet red and basic fuchsin ointments, do not promote epithelialization of an ulcer without due regard for the pathologic etiology of the ulcer, and when regard for this factor has been taken into account, the use of such stimulants is unnecessary.

HÆMATOMA IN THE SHEATH OF THE RECTUS MUSCLE FROM RUPTURE OF THE DEEP EPIGASTRIC ARTERY

Dr. Speese reported the case of a woman, aged sixty-two, who was admitted to the Presbyterian Hospital with the diagnosis of intestinal obstruction. The patient stated that ten hours before her admission, she developed a sudden and severe pain in the abdomen. The pain began in a swelling, situated below the umbilicus, which had been present for one year and which had been pronounced an umbilical hernia by her family physician. The patient was in moderate shock, the pulse rapid and weak, temperature a little below normal, she complained of nausea and had vomited several times. On examination a large mass was found below the umbilicus. This was regarded as a loop of intestine, not in an umbilical, but probably in an interstitial, form of hernia, and operation advised for an apparent strangulation. An incision was made over the

tumor, and on opening the sheath of the rectus muscle, a considerable quantity of fresh and coagulated blood escaped, the slightest manipulation causing profuse hemorrhage. After packing the area from which the hemorrhage arose, and on careful exploration, it was found that the muscle was soft and pulpy, infiltrated with blood, and greatly resembled a strangulated intestine. Finally, the spurting epigastric vessel was disclosed and ligated. The muscle was so degenerated that six inches was removed. Palpation through the peritoneum did not reveal any abnormalities, so that the abdominal cavity was not opened. The sheath of the muscle was carefully sutured and overlapped, and the patient returned to the ward in good condition.

During her convalescence she was questioned more carefully concerning the development of the tumor. She was positive that it appeared suddenly about one year ago, and that there was no strain, blow, or other form of traumatism to account for its origin. On several occasions the mass enlarged slightly and became painful, but never had been so painful as during the last attack. The patient suffered from chronic nephritis and myocarditis, which complications prolonged her convalescence. The wound healed well, seemed solid and there was no tendency toward the formation of a hernia when the patient was seen last, three months after the operation.

Several years ago the author reported before the Academy a case of perirenal hæmatoma, and this case seems to belong to the same group. In perirenal hemorrhage, a definite cause may be demonstrated, such as tuberculosis, neoplasm, traumatism and hæmophilia. The spontaneous form is probably due to chronic nephritis, the only pathologic lesion which has been demonstrable. The same facts apply to the few cases on record in which spontaneous hemorrhage occurred in the rectus or other muscles. Hæmophilia has been noted in some of the cases, in others, as in the case reported, chronic nephritis has been present, and this, along with degenerative changes in the arterial system, may have acted as the etiologic factor in the production of the hemorrhage. It is noteworthy that massive hemorrhage into the perirenal or retroperitoneal space usually excites symptoms suggestive of intestinal obstruction, and that the same symptoms may be produced by hemorrhage into the sheath of the rectus or other muscles.

Dr. Floyd E. Keene said that the case reported by Dr. Speese was similar to one which came under his observation on Dr. Clark's service in the University Hospital and appeared as a post-operative complication. Hysterectomy was performed in the morning and no untoward symptoms followed the operation until late in the evening when, follow-

ing an attack of violent vomiting, there developed symptoms of internal hemorrhage. Operation was immediately done and an extraperitoneal cast of blood-clot was found, the source of hemorrhage being from the ruptured right deep epigastric vein, which was ligated. The peritoneal cavity was opened and found to be free from blood.

Dr. A. P. C. Ashhurst said that he had seen one such case at the Episcopal Hospital in the service of Dr. George W. Norris, in the case of a youth, aged seventeen years, who was admitted to the medical ward January 16, 1912. His illness had begun on January 13, with pain in the left chest, and on admission there was dulness and bronchial breathing at the base of the left lung. On January 18 the leucocyte count was 32,800. Dr. Ashhurst was asked to see him January 24. His temperature ran from 103° to 104° F., his pulse-rate was about 120, and his respirations were from 30 to 38. He was told that he had had a pneumonia at the base of the left lung, with pleural friction. There had been no abdominal symptoms except slight distention for the past several days. His bowels had been opened normally. Recently he was thought to have had pleurisy and perhaps pneumonia in the right lung. There had been no crisis. There were pneumococci in the sputum. The leucocytic count that day was 25,000.

The boy looked desperately sick; he was dyspnœic, cyanosed, flushed, but clear in mentality. He could hardly speak, being very hoarse, with constant cough, and expectorating blood-stained mucopus. The left chest was strapped, and only dry, creaking râles could be heard. The right chest was dull high in the axilla, the breath sounds were well heard, and there were numerous very loud, moist and whistling râles. The abdomen was slightly distended all over; deep respiration was impossible without pain and coughing. In the right hypogastric region a poorly-defined mass was visible. This was very tender on sudden or deep pressure, and was surrounded by tympanitic areas on all sides. There was slight œdema of the overlying skin. There was no cutaneous hyperalgesia. The abdomen elsewhere was flaccid, but slightly distended. Peristaltic sounds were normal. No mass could be felt through the rectum. The bladder was empty.

Under local anæsthesia an incision was made over the swelling. On opening the anterior sheath of the rectus there was a discharge of liquid and clotted blood. The fibres of the rectus muscle were destroyed throughout the whole width of the muscle, and for a distance of about 2 inches longitudinally. The parietal peritoneum was opened, disclosing normal contents. The peritoneum was closed and the cavity in the rectus muscle drained with gauze.

The clots removed from the rectus muscle were examined by Dr. C. Y. White, Director of the Pathological Laboratories of the Episcopal Hospital; muscle fibres were still recognizable in the clot. Cultures of the clotted blood showed "a long chain strepto-diplococcus, not the pneumococcus."

The patient died three days later, January 27, 1912. Autopsy showed no peritonitis, but pneumonia and acute parenchymatous nephritis.

This case may well be classed as one of "spontaneous hæmatoma" of the rectus muscle, presumably due to metastatic infection by hæmolytic streptococci. He objected to the use of the term "rupture" unless there is evidence of injury.

FOREIGN BODIES IN THE SMALL INTESTINE

Dr. George G. Ross reported the case of a woman, aged thirty-five years, who was admitted to the Germantown Hospital, March 2, 1915, with a history of pain in the right lower abdomen. This had been marked during the last six months and was associated with soreness. Occasionally the pains were colicky. The pain was increased by stooping or turning in bed, and by walking. Painful and frequent urination; urine was cloudy at times; there was no leucorrhœa. Her appetite was good and her bowels regular. There were no gastro-intestinal symptoms; the heart and lungs were negative.

The abdomen was flat, no masses to be felt. Pressure in the right hypochondriac region caused pain in the right iliac fossa. There was marked tenderness over the entire right lower abdomen, especially pronounced over McBurney's point and just above the symphysis. Vaginal examination showed a movable uterus, with some retroversion and prolapse. There was a distinct tender mass to the right of the uterus.

The following information was obtained after the operation and this fact accounts for the incorrect diagnosis of tubo-ovarian abscess. She had been an inmate of the State Hospital for the Insane, to the authorities of which we are indebted for the following facts: Their diagnosis was constitutional psychopathy. She had attempted abortion in all four pregnancies. During the last pregnancy, three years ago, she had made almost constant attempts to empty the uterus. Among the methods employed were three boxes of Hooper's pills; gin and celery seed of which she took three quarts; and fifty cents' worth of Epsom salts taken in one day. On the advice of a clairvoyant she took a cupful of hot claret at the same time, soaking her feet in hot water containing a pint of chopped onions. She developed suicidal tendencies,

one of her methods being the swallowing of pins, twisted bunches of hairpins, safety-pins, etc. After two years of treatment she recovered her mental balance and was discharged.

Operation.—Right rectus incision. The terminal ileum was bent on itself and the sides of the bowel were adherent to each other and the apex of the mass was adherent to the bladder. The knuckle of bowel contained a foreign body which felt like calcareous plates. This portion of the bowel was resected and lateral needle and thread anastomosis was made. The tubes and ovaries were normal. The wound was closed without drainage. The resected gut contained eighteen to twenty pieces of thin, blackened wire resembling Gem paper clips or curtain hangers. One clip had perforated the wall of the bowel and projected into the peritoneal cavity.

Dr. Addinell Hewson said that he had found in the dissecting room of the Polyclinic a cadaver in which two steel needles had been forced by the patient between the occiput and the spinal column through the foramen magnum into the medulla and which were stuck against the ventral margins of the foramen magnum. In addition the patient had two needles of the same character in the nasal cartilage in front of the nasal bones. Her stomach was of enormous size. The needles had been in the spinal cord apparently for a long time because they were rusted. The woman was an insane patient and was from the same hospital from which Dr. Ross's patient came.

TORSION OF THE OMENTUM

Dr. George G. Ross reported the following case: A woman, forty years of age, was admitted to the German Hospital, August 13, 1915. Her chief complaint was pain in the lower right abdomen. Her trouble began five days prior to admission with pain in the upper abdomen, soon becoming general. Two days later the pain had localized in the lower right quadrant. There were 6200 leucocytes, a temperature of 100° and a pulse of 108. There were no chills. Appetite, bowels, heart, lungs, and kidneys were normal. This was her first illness. Family history was negative. Husband and four children well.

Examination was negative with the exception of a point of marked tenderness at McBurney's point. An ill-defined mass could be made out in the lower right quadrant. A diagnosis of acute appendicitis with abscess was made.

Operation.—The appendix was found acutely inflamed and covered with lymph. The omentum was found twisted on its long axis for about eight inches, there being three complete twists. It was dark purplish-red, congested, but not gangrenous. The appendix and omentum were removed as was an epiploic appendix which had become adherent to the mesentery of the ileum. The recovery was uninterrupted.

GALL-STONE ILEUS

Dr. John H. Jopson reported the case of a woman, aged fifty-eight years, who had suffered for a long time with what was termed indigestion. She had been sick a week before admission to the hospital. The onset was sudden, marked by pain and diarrhœa, and following this no movement of the bowels could be obtained for six days. For the purpose of relieving the obstruction she had been given enormous doses of cathartics, including citrate of magnesia, blue mass, castor oil, calomel and rhubarb, as well as high compound enemas and opium. Vomiting was frequent and had been fecal for more than 24 hours before admission to the hospital. She was in fair condition; pulse and temperature not materially altered, abdomen flaccid, no areas of tenderness. No tumor could be felt and the rectum was empty. The stomach when washed out was found to be full of fecal matter. As soon as the abdomen was opened, the obstruction was located in a loop of the ileum, lying down in the pelvis. It was recognized to be a gall-stone and was removed by linear incision of the bowel. The opening was closed in the usual manner by two layers of sutures. The stone measured three inches in length by three-quarters of an inch in width, was smooth, oval, of an olive color and weighed 25 grammes. The bowel contracted very much at the point of suturing, evidently from muscular spasm. There were numerous adhesions in the hepatic region and no attempt was made to explore further in this direction. The first examination of the urine had been reported negative, but a second examination two days after operation revealed the presence of sugar, and in subsequent examinations as high as 3 and 4 per cent. was present; also acetone and diacetic acid. The patient's condition was poor after operation and there was marked cardiac weakness and paresis of the bowel, which responded to the exhibition of eserin, after pituitrin had been given without result. Probably as a result of an old diabetes, there was absolute failure of the wound to heal, although convalescence for the first week was almost afebrile. The wound opened up throughout its entire length and a loop of bowel protruded and the granulating process was exceedingly sluggish. At the same time, the patient's physical and mental condition were very bad. At the end of six weeks, as a result of diet and general medication, the acetone and diacetic acid had disappeared from the urine and also the sugar. The patient later

developed a phlebitis, first in the left and later in the right leg, with occasional chills and rises of temperature, and succumbed rather suddenly seventy-eight days after operation to what was apparently a pulmonary embolus.

The history of this case as regards the gall-stone ileus is very typical of obstructions of this nature. The long duration of the obstruction before it became alarming to her medical attendants, is explained by the fact that these obstructions are seldom complete in the early stages, and there is an absence of strangulation of the bowel, while spasm of the muscle fibres of the intestine is, according to Duplay and Reclus, responsible for most of the obstructive symptoms. The characteristic symptoms, according to Barnard, are the sudden onset, the absence of pain and collapse until late in the attack, the incomplete obstruction and the absence of tenderness and distention of the abdomen. Vomiting is a prominent symptom, being severe and continuous, while jaundice and true biliary colic are generally absent in the case of large stones. The mortality is high. The development of a septic phlebitis was undoubtedly responsible for the lethal termination of the case seventy-eight days after operation, and this phlebitis was probably dependent upon the toxæmia due to prolonged obstruction, the diabetic condition, and the delayed wound healing.

Dr. Alfred C. Wood said that he had had the opportunity of operating on three cases of gall-stone ileus. The first case was that of a woman about fifty-eight years of age, with no previous history of indigestion or other illness, with the exception that at eight months prior to admission to the hospital she had an attack of pain which was thought to be due to pleurisy. During the three months prior to coming into the hospital she had attacks of constipation alternating with diarrhœa. At the operation a gall-stone was found in the ileum about 6 inches from the cæcum. As this stone was faceted, other stones were looked for, and a second stone discovered in the act of passing from the gall-bladder to the duodenum.

In the second case the diagnosis was made on account of the history of an attack some months before, that strongly suggested a gall-stone attack. The stone was found in approximately the same situation as in the preceding.

In the third case, the stone was of larger size and had been arrested at about a foot from the valve. A very careful study of the patient's history will sometimes enable one to suspect the cause of the obstruction in these cases.

MULTIPLE CARTILAGINOUS EXOSTOSES (HEREDITARY DEFORMING CHONDRODYSPLASIA)*

WITH NOTES OF NINE HITHERTO UNPUBLISHED CASES

By Astley Paston Cooper Ashhurst, M.D.
of Philadelphia

The clinical entity which goes under the name of multiple cartilaginous exostoses has recently been studied by Ehrenfried, who prefers the name hereditary deforming chondrodysplasia. According to Rendu and Levy its relation to chondrodysplasia was recognized by Ollier as long ago as 1899. G. G. Davis says it was described as a clinical entity by Cæsar Hawkins, in 1837. Ehrenfried found only about twelve cases which have been reported in America, the greatest number being reported from Germany and France. Inasmuch, however, as I have myself had the opportunity to see no less than eleven such patients within the last ten years it is evident that the affection is not really rare, but merely has been ignored, because there is so little that can be done in the way of treatment.

The affection is more frequent in males than in females, is distinctly hereditary, may be transmitted by both affected males and females, but there is no good evidence that it may be transmitted by unaffected males, though it may be transmitted by unaffected females (Reinicke, 1890; Lippert, 1903). The essence of the disease is not the exostoses; these are merely incidental (Lenormant, 1905). This has received especial recognition since the more common use of X-rays, but was suggested by Ollier and others long before the advent of skiagraphy. As a matter of fact, the underlying pathological change is a chondrodysplasia, affecting especially the metaphyses of the long bones, though the bones of the pelvis, the clavicles, scapulæ and the vertebræ may be involved also. In skiagraphs the bone ends may look cystic (Fig. 2), owing to irregularly distributed areas of cartilage in the metaphyses. The epiphysis itself is small or misshapen, the intermediary cartilage is narrow, irregular, oblique, or zigzag, and sometimes prematurely ossified (Lenormant, 1905). Scattered along the ends of the shaft beneath the periosteum are to be found clumps or nests of cartilage cells persisting uncalcified where they

*Read before the Philadelphia Academy of Surgery, October 4, 1915.

were left in the process of growth. Later these groups may develop into cartilaginous exostoses or chondromas (Ehrenfried, 1915).

Certain secondary characteristics usually but not always are present, and are easily recognized (Bessel Hagen, 1891). These are a low stature, due to shortness, not of the trunk, but of the limbs; as a rule the lower limbs are more shortened than the upper. There often is a lack of growth of the ulna, resulting in relative overgrowth in length of the radius, which becomes luxated at one or both ends, especially at the elbow. Thus the condition has been mistaken for "congenital dislocation of the radius," and according to Bessel Hagen most cases so described really were cases of this dyschondroplasic affection and in no sense instances of a congenital dislocation. Pes valgus is a frequent development from lack of growth of the fibula, with relative overgrowth of the tibia.

The deformities above enumerated may come before the exostoses, and the latter may never develop. Exostoses may develop in cases of very slight or insignificant deformities; or exostoses may be present on undeformed bones while the same patient may have other bones which are deformed but without exostoses.

Occasionally a malignant osteocartilaginous tumor develops in one of the exostoses. Ehrenfried says Lenormant and Lecène collected 24 such cases, and he has himself found references to about a dozen more.

Patients usually come under observation at or about puberty, for pes valgus, for painful pressure by one or more exostoses, or for general bone pains. After skeletal maturity the disease usually ceases to progress; but in the remarkable case reported by G. G. Davis (recorded below as Case 10) a man who had had exostoses since childhood began to develop new tumors when past fifty years of age, after a quiescent period of more than 30 years. In the patient recorded below as Case 8, moreover, there is no certain knowledge of the existence of the exostoses before the age of thirty years. But if we remember that exostoses are incidental features of the affection, there is no reason, so far as I can see, to deny the possibility of their appearing for the first time in adult life.

I give below a brief abstract of the cases which have been under my own observation. Unfortunately the hereditary character of the disease is not very apparent in this series, most patients denying that any other members of their family were similarly affected. But it is very likely that closer investigation might have discovered some such cases.

Case I.—Ella C. M., aged four years, was referred to the Orthopædic Service of the Episcopal Hospital by Dr. Henry Winsor and Dr. James W. Ellis, September 20, 1915. This girl is her parents' only child; the mother has had no other pregnancies. The parents are both healthy, and the family history is otherwise negative. The child was normal at birth. From the age of 11 months to 20 months she suffered from enteritis, and had an intercurrent attack of measles at the age of one year. Since then she has been healthy, with the exception of an attack of varicella about three months before coming under observation.

About one year before seen by Dr. Ashhurst, the child fell and bruised her left knee. When her mother came to rub it for her she found a lump on the outer side above the knee. No further trouble was experienced, and it was not until about six or seven months later that the mother noticed similar bony lumps on the upper part of the left humerus and at the right elbow.

Examination at the present time shows a fairly well developed and nourished child, with no subjective symptoms. The mother thinks the lumps have not increased in size much if at all since they were first noticed. There are exostoses in the following locations: Two on the spine of the right scapula, one on the upper angle of the left scapula, one on the fifth right rib, near its cartilage; one on the upper end of each humerus, that on the right apparently arising from the lesser tuberosity, and that on the left from the greater tuberosity; one on the upper end of the right ulna, inner side; one above the external condyle of the left femur; one above the external malleolus of the left fibula.

The head of the right radius is unduly prominent, as if subluxated.

Many skiagraphs were taken, but as the child was very refractory and would not be still, none of them are sufficiently good to be reproduced as half-tone illustrations.

Case II.—Philip W., twenty years old, seen in Dr. Davis's service at the Orthopædic Hospital, April 17, 1906 (Book xviii, p. 118). Exostoses first noticed at age of three months. There are now exostoses on nearly all the bones; in both forearms the radii are longer than the ulnæ, and the hands deviate to the ulnar side. There is moderate valgus in both feet.

Case III.—Edna U., eleven years old, negress. Seen in my dispensary service at the Children's Hospital, August 13, 1907. There are four other healthy children, and so far as known no one else in family has any similar affection. No history of tuberculosis. The patient began to walk at age of nine months, and so far as family knew was perfectly normal until three years ago,

when exostoses began to appear, and have been growing larger since. She comes for pains in her bones. The photograph (Fig. 1) shows many of the exostoses. The right radius was 21 cm. in length, and the left 18.5 cm. There is some shortening of the ulnæ, and slight valgus in both feet from deformities in the leg. She was under treatment at this time for 7 months, and her pains lessened while taking the syrup of the iodide of iron. Three years later she was seen at the Orthopædic Hospital, in Dr. Davis's service, for pronounced valgus in both feet. As the condition was painful, braces were ordered including the legs.

CASE IV.—Fred R., aged seventeen years, was seen in Dr. Davis's service at the Orthopædic Hospital, November 12, 1907 (Book xx, p. 14). The family history is recorded as negative. The boy had had typhoid fever in 1897, when eight years old. About one year later he first noticed an exostosis over the upper inner end of left tibia. One year later a similar growth appeared in a corresponding situation on the right leg. Then gradually others formed all over the long bones. The left knee is markedly bowed (outward). The right lower extremity measures 88 cm., and the left 91 cm., being longer than the right in spite of the bowing of the knee.

CASE V.—Henry B., fifteen years old, was seen in Dr. Davis's service at the Orthopædic Hospital, January 21, 1908 (Book xx, p. 62). His brother, with the same affection, is recorded below as Case VI. Another brother, also said to have multiple exostoses, was not seen. Henry has had the affection for seven or eight years, and for five years had to wear leg braces on account of pain and weakness. There are exostoses on all long bones, on both clavicles, both scapulæ and on the pelvis, but none on the hands or feet.

CASE VI.—Mason B., aged thirteen years, seen in Dr. Harte's service at the Orthopædic Hospital, March 19, 1908 (Book xiii, p. 58). Two brothers have multiple exostoses. One is recorded above as Case V. Mason has noticed the present condition about two years. He comes for valgus deformity in both feet. The right leg, from knee to ankle, is 1.5 cm. shorter than the left.

CASE VII.—Herbert T., aged fourteen years, seen in Dr. Harte's service at the Orthopædic Hospital, February 11, 1909 (Book xiii, p. 215). The boy came for weakness in the left arm, which had existed for a year. There was paralysis of the left ulnar nerve, evidently due to pressure of a bony mass in the neck (Fig. 2). Over this mass there was a keloid scar from an operation performed four months previously in another hospital. So far no improvement had followed this operation. There were also exostoses of the right humerus, left femur, left tibia and

FIG. 1.—Case III. Multiple cartilaginous exostoses in a negro girl of eleven years.

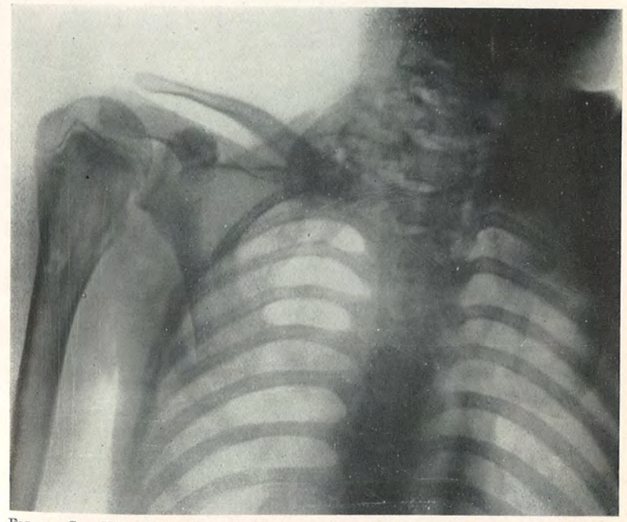


FIG. 2.—Case VII. Multiple cartilaginous exostoses. The mass in left side of neck has caused paresis of ulnar nerve. Note involvement of vertebral border of scapula, exostosis on upper metaphysis of humerus and cystic (cartilaginous) appearance of underlying bone.

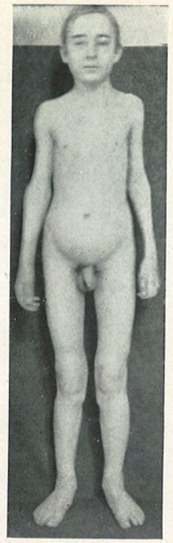


FIG. 3.—Case VII. Multiple cartilaginous exostoses.

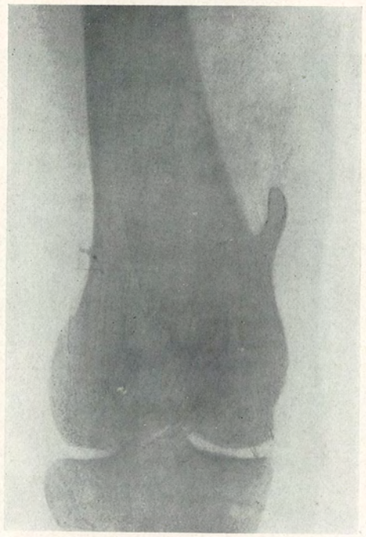


FIG. 4.—Case XIV. Exostosis above internal condyle of femur.

FIG. 5.—Case XV. Exostosis excised from humerus.

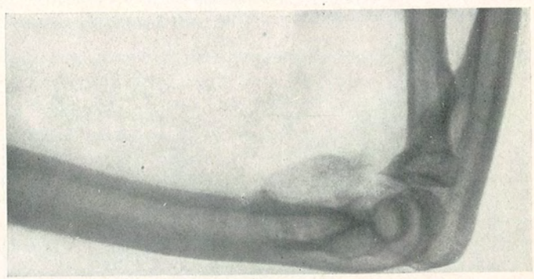


FIG. 6.—Case XVII. Traumatic hyperostosis of the humerus, four months after a fall on elbow.

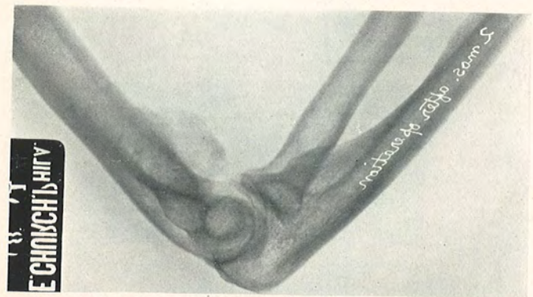


FIG. 7.—Case XVII. Recurrence of hyperostosis of humerus two months after operation.

FIG. 8.—Case XVII. Gradual absorption of new-formed bone, nine months after operation.

fibula. A photograph (Fig. 3) shows considerable valgus deformity in the feet, and moderate shortening of the upper extremities, and some of the lower extremities, as the midpoint of stature is not at the pubis, but half way between it and the umbilicus.

CASE VIII.—Alexander M., thirty years old, seen in Dr. Davis's service at the Orthopædic Hospital, June 8, 1909 (Book xxii, p. 19). The family history is negative. The patient had never been ill, and denies all venereal disease. The present complaint was noticed after what he calls an attack of "rheumatism" for which he says he was treated from December, 1908, to March, 1909. Until the latter date he did not know of the existence of any exostoses. At this time Dr. Davis removed an exostosis from the left femur, which was pressing on the sciatic nerve (possibly the cause of his "rheumatism" during the winter), and one from the left fibula.

CASE IX.—Mary R. B., aged seven years, seen in Dr. Davis's service at the Orthopædic Hospital, August 10, 1909 (Book xxii, p. 84). The exostoses were noticed before the child was one year of age. They are present on all four extremities, on the scapulæ, and one is forming on the left ribs. The child was brought for pronated feet.

I have also seen the two patients reported by Dr. Davis in the monograph already mentioned:

CASE X.—A man, aged fifty-three years, whose exostoses began to appear when he was about ten years old. After the age of fifteen or sixteen years, the disease became more or less stationary, except for gradual impairment of joint motions. At the age of fifty-two years an exostosis developed on the left ramus of the pubis; this growth subsequently grew smaller while the patient was under Dr. Davis's observation. The man suffered from considerable pain in his bones, and was incapacitated for work. A photograph published by Dr. Davis, as well as numerous skiagraphs, shows the typical deformities characteristic of the disease, namely, relative shortening of ulnæ, with ulnar deviation of the hands, and subluxation of the head of the left radius; right knock-knee, and valgus in both feet.

CASE XI.—A child (sex not recorded) aged three years, with multiple exostoses, which were first recognized by the mother before the child was one year old. The digital phalanges were involved as well as all the long bones of the limbs. The child also was rhachitic, and knock-knees were present.

There are also brief records at the Orthopædic Hospital of the following two patients, in Dr. W. J. Taylor's service. They did not come under my personal observation:

CASE XII.—Edward S., aged sixteen years, January 26, 1907 (Book xiii, p. 12). Has had knock-knee since childhood; had typhoid fever 4 years ago. Has several exostoses on or near each knee.

CASE XIII.—Hugh McN., aged thirty-four years, March 5, 1910 (Book xv, p. 31). Has presented symptoms due to exostoses for 2 years. Exostoses are present at right wrist, left elbow, and left scapula.

Owing to lack of details it is not certain that these cases (XII and XIII) are instances of hereditary deforming chondrodysplasia. But the more one looks into the matter, the more difficult does it become to draw any definite lines between well defined "typical" cases and those which are just on the verge of typical. At the other end of the scale come those patients who present one or at most two or three exostoses, which have developed without any evident cause, or have been discovered after a slight injury which may or may not have been an etiological factor. These patients present no indication of any hereditary affection, and no skeletal deformities are noticed. It is of course possible that in such cases a thorough skiagraphic examination might reveal evidences of chondrodysplasia in bones showing no other evidences of disease, or might even show other insignificant exostoses.

The following cases, for instance, are to my mind examples of chondrodysplasia of some sort:

CASE XIV.—Annie S., aged sixteen years, was seen in Dr. Harte's service at the Orthopædic Hospital, July 27, 1911. Two years previously she had struck her left thigh against the runner of a sled, and three months later a bony lump appeared. She complained of pain in the lower part of her left thigh when walking. The lump was a typical cancellous exostosis, springing from the femur above the internal condyle (Fig. 4), and I excised it with the cortex from which it sprang, September 7, 1911.

CASE XV.—Jennie F., aged thirteen years, referred to my service at the Episcopal Hospital by Dr. R. S. Hooker, in May, 1914. A bony lump had been noticed at the right shoulder for three weeks; there was no history of injury. The exostosis, springing from the humerus and presenting beneath the anterior fibres of the deltoid muscle, was excised with the underlying cortex, May 13, 1914 (Fig. 5). There has been no recurrence to date.

CASE XVI.—Grace J., aged fourteen years, came to my service at the Orthopædic Hospital, October 31, 1914. About September 1, 1914, she had fallen on the stairs, and twisted her shoulder in the banisters. About a month later she noticed a lump on the right scapula. This caused pain, and seemed to be growing larger. On December 12, 1914, I excised it. It sprang from the upper vertebral angle, and the portion of bone from which it grew was removed in one piece with it, including the entire thickness of the scapula. Recovery was uneventful. About four months later the girl returned, complaining of neuralgic pains beneath the right pectoralis minor, and shooting back to the scapula. Skiagraphs showed no bony lesion. The girl was referred to the nervous department of the hospital for an opinion, and Dr. F. W. Sinkler reported that he considered her neurasthenic. At all events she recovered from her pains without further surgical treatment.

Two utterly different types of cases, it seems to me, are those recorded by me in the remaining pages of this article—one a traumatic hyperostosis, the other an instance of osteophytes accompanying chronic hypertrophic arthritis.

CASE XVII.—*Traumatic hyperostosis of the left humerus, recurring after operation, but eventually disappearing spontaneously.*

Mary D., aged twenty-four years, was seen in the Orthopædic Service of the Episcopal Hospital, June 1, 1914. Four months previously she had fallen down ten steps, landing on her left elbow. Her physician said it was dislocated, but an X-ray showed no bone lesion. It was bandaged for some weeks, but remained painful.

When examined at the Episcopal Hospital, four months after the accident, there was marked disability, with constant pain in and above the elbow. There was full extension and normal rotation, but flexion of the elbow was stopped by bony contact at 80 degrees. A bony mass could be felt in the flexure of the elbow a little to the median side of the midline between the condyles. An X-ray showed a mass of bone in the flexure of the elbow (Fig. 6) apparently arising from the humerus, possibly from the muscle. The patient readily consented to have the excessive bone removed by operation, as she was unable to do her work (housework).

Operation (June 29, 1914).—Under Esmarch anæmia a longitudinal incision was made along the median edge of the biceps muscle, displacing the brachial vessels and median nerve to the median side. This gave ready access to the growth, which, as shown by the X-ray, sprang from the humerus, nearer its median than its lateral border. The growth extended down to the trochlear surface. It was covered by periosteum which appeared normal, and did not in any way involve the muscles. The mass with its overlying periosteum was removed by gouge and mallet, until the normal contours of the humerus were restored, and normal flexion of the elbow was possible.

The pathological report, by Dr. C. Y. White, Director of the Pathological Laboratories of the Hospital, stated that the specimen was composed of cancellous bone containing areas of granulation tissue.

July 20: Elbow flexes further than before operation. A bony mass is still felt over the lower anterior part of the humerus.

August 3: Flexion to 65 degrees and full extension.

August 31: Flexion to 60 degrees. Some pain in damp weather.

X-ray shows recurrence of bony growth in flexure of elbow (Fig. 7).

March 8, 1915. Nine months after operation. Flexion to 50 degrees, extension normal. Never any pain or disability. X-ray shows scarcely any thickening of the shaft at the site of the former hyperostosis (Fig. 8).

CASE XVIII.—*Osteophytes of humerus, accompanying chronic arthritis of the shoulder; excision with permanent relief of symptoms.*

John C., aged sixty-two years, broom-maker. Blind since age of twelve years, as the result, he says, of an attack of typhus fever. He was seen in the Orthopædic Service of the Episcopal Hospital, August 5, 1913. About 15 years previously he had fallen and injured his right shoulder, and it had given him constant discomfort since. In December, 1912, this shoulder gave a sudden crack while at his work of making brooms, and he had been unable to work at all subsequently until the present, on account of the pain in his shoulder on any motion.

Examination showed a well-preserved but thin old man, not at all robust. There was no limit to passive motion in the shoulder-joint, but very marked crackling on external rotation and very great tenderness over the tuberosities. On elevation of the arm the tender points disappeared under the acromion. A skiagraph showed no bony lesions other than some hypertrophic changes in the acromioclavicular joint, where he had no symptoms. Operation was undertaken as an exploration, in the expectation of finding some periarthritis with bursal adhesions.

Operation (August 15, 1913).—Ether. An incision from the point of the acromion downward for three inches was made, splitting the anterior fibres of the deltoid. No evidence of any subdeltoid bursa was found. Immediately beneath the deltoid the very thin capsule of the shoulder-joint was exposed, and on opening this the head of the humerus was found to be eroded and flattened. The external part of the head was much flattened, and there were two osteophytes at the margin of the articular cartilage (just at the reflection of the capsule on to the anatomical neck), which caught on the capsule during rotation outward, and caused a distinct *jump* and crackling. These two osteophytes were removed by gouge. They were about 6 or 7 mm. high. The long head of the biceps, on the inner side of the incision, seemed to be intact.

Pathological Report (Dr. C. Y. White).—Compact bone, denser than normal, covered with cartilage on its free surface. No evidence of inflammation.

The subsequent history is brief and satisfactory. The wound healed promptly, all pain was relieved, and the man returned to his work. He was last seen September 6, 1915, more than two years since operation. He has not had a pain or a twinge in that shoulder since operation, and continues his work without disability, except that he is now developing a Dupuytren's contracture in the palm of the right hand.

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DR. GWILYM G. DAVIS said that not infrequently these cases of multiple exostoses are seen in early adult life and in youth, and he did not think there is much doubt but that evidence of them exists in infancy. It is well to bear this in mind; otherwise the disease will be considered a new and active one, whereas it is a congenital trouble and of old standing. In some cases, in which only one or two exostoses are seen, if the X-ray were applied other parts would be found to be involved. This would account for some of the single exostoses supposed to be started by trauma.

DR. JOHN H. GIBBON asked Dr. Ashhurst whether syphilis plays any part in this disease of multiple exostoses. That was one of the causes assigned to the condition in a very marked case in his hospital service last year in which practically every bone in the man's body was involved. That man had had syphilis, but it is quite possible that he had the disease before he developed syphilis.

DR. ASHHURST, in closing, stated that the evidence is against syphilis being an etiological factor.

TANNERS' ULCER*

CHROME SORES—CHROME HOLES—ACID BITES

By John Chalmers DaCosta, M.D.
and
John F. X. Jones, M.D.
of Philadelphia, Pa.
WITH BACTERIOLOGICAL AND PATHOLOGICAL STUDY
By Randle C. Rosenberger, M.D.

A surgeon should know much of the nature of many callings in order that he may understand the particular dangers to which the workers in each trade are exposed. In some callings the workman is in danger of wounds and injuries more or less grave; perhaps often fatal. The stress and strain of some shatter the nervous system. In some lack of exercise and contaminated air undermine the general health. In some irritant materials produce lesions of the surface of the body. In some poisons are absorbed and produce disease or death. In statistical tables, callings in which there is definite risk are designated as *dangerous occupations.*

We might give the following instances: Structural iron workers; workers in oil refineries; subway laborers; miners; railroad men; firemen in large cities, and workers in various other strenuous vocations are exposed to violence which may cause trifling injury or perhaps frightful mutilations. Caisson workers are liable to a peculiar disease. Locomotive engineers, overharassed professional men, business men during a financial crisis, persons living on the edge of ruin or exposure to disgrace, women in men's occupations, suffer from nervous strain and its resultant maladies.

In estimating the strain of an occupation it is interesting to note that the suicide rate in any calling is a fair measure of its strain and that the suicide rate is lower among beggars than in any other class.

Certain occupations cause definite neuroses. We may mention writer's cramp, telegrapher's cramp, pianist's cramp, typewriter's cramp, sewer's cramp, hammerswinger's cramp, etc. Sweatshop workers and dwellers in sunless alleys, those who live in the rabbit warrens of the tenements, are peculiarly liable to tuberculosis.

Among dangerous callings are the following: Work in lead, antimony, arsenic, mercury, copper, yellow phosphorus, carbolic acid,

* Read before the Philadelphia Academy of Surgery, October 4, 1915.

bisulphide of carbon, picric acid, certain petroleum products, nitro-explosives, and nickel carbonyl. The absorption of poisonous materials into the tissues of one who works with poisons produces results depending upon the material and the amount absorbed and the condition of the subject.

The local effects of irritants used in industrial processes are seen among workers in many callings. There are many forms of trade eczema and industrial ulcer. Electro-platers who work in strong soda solution may develop ulcers and fissures of the hand. Electro-platers may also get cyanogen sores. Bakers' itch is from working in flour and yeast; grocers' itch from sugar. Shoemakers, bartenders, stonecutters, plasterers, bricklayers, printers, bookbinders, cigarmakers, photographers, chemists, surgeons, wood-workers and metal cleaners are prone to occupation eczema. Anthracene, a material from which alizarin dyes and a paint to preserve wood are made, is apt to cause the development of pustules on the skin and sometimes cause cancer. Workers in coal-tar and paraffin workers are liable to dry erythema, acne, pigmentations, pustules, boils, keratoses and warts; and a wart or an area of keratosis may become cancerous. In aniline and benzidine workers not only does cancer of the skin occur but also cancer of the bladder. Lampblack workers suffer from eczema of the toes, wool-sorters may get anthrax, salt grinders and salt handlers may develop ulcer of the nasal septum, and mother-of-pearl grinders may develop hypertrophy of a bone or bones and may suffer attack after attack of bone inflammation.

Among irritant materials used in certain industrial processes we must note chromic acid and its salts. This material in some form or other is used in photography, in calico printing, in bank-note printing, the ceramic industry, the manufacture of safety matches, dyeing, glass making, bleaching oils, purifying wood spirit and tanning hides.

It has long been known that the dust of chromic acid or the chromates can cause ulceration of the nasal septum and that the acid or the chromates, as dust or in solution, by acting upon the skin may cause ulcers.

Over twenty years ago one of us (DaCosta), then one of Professor Keen's assistants in the Jefferson Hospital, became interested in certain peculiar ulcers to which tanners were found to be liable, although occasionally a cloth handler or a dyer developed one. These ulcers were found to be most common on the hands, especially the fingers, but the feet were not entirely exempt. It was noticed that the ulcers tended to penetrate deeply, that few of them tended to spread much

laterally, that they were painful, resisted all treatment until the occupation was abandoned, showed no sign of tuberculosis (cultures for tubercle bacilli proving negative), were not improved by antisyphilitic treatment, and after healing left permanent scars.

Further investigation showed that none of those attacked had worked in the old tanbark methods of tanning, but all had worked in the then recently introduced chrome process, which was being actively developed for the tanning of kid by Mr. Robert Foederer, of Philadelphia.

The only workmen in the tanneries who suffered were those who actually worked with the bichromate salts. Surgeons had heard of lesions arising in workmen engaged in the manufacture of bichromate of potash in chemical works, the lesions consisting of cutaneous ulceration and perforation of the cartilaginous septum of the nose. There was no record of such lesions occurring in tanners. Previous to this time the chromic process had scarcely been used.

A study of these ulcers was undertaken and a number of cases were investigated clinically and bacteriologically. The assistant engaged in the bacteriological part of the work tired and fled, the study broke down and was not resumed until recently.

Throughout the years which followed that abortive investigation every now and then a tanner suffering from an ulcer has presented himself for treatment at the surgical dispensary. The assistant came to speak of such sores as " tanners' ulcers " or " leather workers' ulcers." We still see these cases, though far less often than formerly because in certain parts of the tanning process machines have been substituted for hands.

Recently through the kindness of the proprietors of a number of tanneries in Philadelphia, Wilmington and Camden, we have seen and gathered together for study a number of these cases and purpose report upon them.

We will first set forth the literature on " chrome sores " in general, that is to say, of chrome sores as they occur in various occupations. We will then report upon our cases which occurred among tanners and will discuss the condition.

" CHROME SORES IN GENERAL "

Chromium and the chromates were discovered by Vauquelin in 1797. The chromates have been employed in certain manufacturing establishments since before 1819. On page 156 we mention some of the industries in which they are used.

Robert Christison (*A Treatise on Poisons,* 1829) tells us that chrome sores were described to him by his late colleague, Duncan, of Glasgow. His patients were dyers who worked in vats containing bichromate of potash. Christison states that these sores spread deeply but not laterally.

D. G. Gmelin, of Tubingen, in his Treatise on the Effects of Some Metals (quoted in *Edinburgh Med. and Surg. J.*, vol. xxvi, 1826), speaks of sores developed by Glasgow dyers who immersed their hands in bichromate solutions. The sores do not extend laterally, but go deeper and deeper and may penetrate the hand or forearm.

T. J. Ducatel, of Baltimore, studied chrome sores in chemical workers (*Manual of Practical Toxicology,* 1833). He states that if one who works in chrome has an abrasion of the cuticle a painful ulcer results; but if the cuticle is unbroken, even a strong solution fails to produce ulcerations. The writer states that chrome sores are well known to Baltimore chemical workers in factories where bichromate of potash is made. He asserts that Duncan's cases among dyers were due to free chromic acid in the fluid. He describes these sores in the words of Gmelin without giving credit to the celebrated Tubingen professor. He presumes that the neutral chromate can only induce slight inflammation. The bichromate causes much more violent symptoms.

Ducatel, in a footnote, quotes Baer as having seen twenty cases of chrome ulceration. Baer describes the ulcers as painful, burrowing, persisting in spite of treatment and tending to penetrate the limb unless the victim abandons his work. Baer asserted he had seen ulcers on parts of the body which the solution did not touch, and that such ulcers could only have been caused by the vapor of chromic acid.

In 1851 Chevalier, Sr., addressed a note to the Institute calling attention to the dangers run by those who worked in chromates. Heathcote (*Lancet,* February 4, 1854) reported ulcers of the throat occurring in workmen who handled chromate of potash, and claimed that such lesions might be fatal.

M. A. Delpech (*Bulletin de l'Académie Impériale de Médecine,* vol. xxix, 1863–1864) considers certain ailments of those who make bichromate of potash. He mentions pustules and gangrenous sores of the hands and feet (especially of the sides of the fingers and toes). These ulcers he says exhibit temporary induration, tend to perforate, and leave indelible scars. He further points out that ulcerous eruptions may occur on the arms, limbs, trunk or genitals; that ulcers are due to direct contact with neutral or acid chrome; that bichromate is the more active irritant of the two; that in some subjects rhinitis arises and ends

in destruction of part of the cartilage of the nasal septum; that the perforation is usually rapid and the cartilage never reforms; that the sense of smell is seldom lost; that in some cases the perforation is insidious, without coryza; that the eyes, upper respiratory passages and stomach remain unaffected; that snuff takers seldom lose the septum from chrome perforation; that the nasal trouble is due to the vapor from the caldrons; and that both septum perforation and cutaneous ulceration are due to the escharotic action of chromic acid or a chrome salt.

In the same volume of the journal containing Delpech's paper is a paper by Hillairet on the dangers in making bichromate of potash.

In 1863, Chevalier, Sr., and Bécourt published a paper on the accidents to which chrome makers are liable (*Annales d'Hygiène,* July, 1863). The paper is founded upon an investigation conducted by Clouet and contains data obtained from Zuber and Ehrmann, of Riksheim, and Isaac Tyson, of Baltimore.

In January, 1869, and in January, 1876, Delpech and Hillairet (*Annales d'Hygiène Publique et de Médecine Légale*) published studies of the accidents which occur to chrome workers. The paper contains a review of the very scanty literature, the report of an investigation of the hygienic conditions of chrome workers, a description of the process of manufacture and a clinical study of the health impairment due to chromate. It describes chrome sores of the hands and cases of perforation of the nasal septum and mentions that nasal perforation results from inhalation of chromate dust. In the same journal in January, 1876, there is published the second part of their study. The authors mention that though bichromate is distinctly more irritating than neutral chromate, neutral chromate can cause irritation (this fact has been disputed by manufacturers). They cite instances of animals who have walked about in a slop of neutral chromate and have developed ulcers on the feet, and report cases of perforations of the nasal septum due to the neutral salt.

The authors say that the ulcers are characteristic, that they are due to escharotic action and most of them arise in excoriations. In some cases there is perforation of the cartilage of the nasal septum, in some bronchitis, headaches and loss of weight. Ulcers of the throat simulating syphilis have been reported, but it is unquestionable if chrome causes them. If the hands are free from abrasions, they can be put in vats freely, but the slightest break will lead to ulcer. If there is an excoriation, violent pain will be experienced at the moment of contact with the chrome salt. These ulcers are much worse in the cold of winter.

After an ulcer once begins it quickly indurates and in a few days a spongy, soft slough forms. These sloughs separate very slowly by peripheral ulceration. The sloughing area does not increase laterally unless more chromate is introduced, but it goes in deeper and deeper and usually reaches the bone; but once it does so, it stops. The edges of these ulcers are sharp cut and frequently show cicatrization. The core or slough is slowly separated, leaving a clear ulcer with a gray floor.

If a man stops work at once after the beginning of the ulcer, the sore quickly heals, but even then it leaves a permanent scar. The most common situations are in the articular folds on the back of the hand. He may get vesicles, pustules or eczema on various parts of the body. Sores on the body may be due to scratching with contaminated hands or may be due to dust settling through openings in the garments (it is to be remembered that the paper deals with chemical workers). The authors do not think that the systemic absorption of the chromium ever causes poisoning. Those who take snuff seldom develop perforation of the septum. Smell is seldom lost after septal perforation. After perforation has once occurred a second one never develops, because the contact of the mucous membrane of the two sides of the nasal passage has become impossible. The authors do not think that abrasions are a necessary antecedent of ulcers. If they were ulcers could not form on so many different parts of the body.

The writers then discuss at length industrial hygiene and prophylaxis.

In the quarterly publication for *Judicial Medicine,* vol. x, 2, 1895 (edited by A. Wernich), Dr. Paul Muller discusses perforating ulcer of the nasal septum. He says that the dust of many salts besides the chromates may be responsible. He mentions sodium chloride and potassium chloride.

Dr. J. William White (*University Medical Magazine,* November, 1889) reported a case in which he had used chromic acid as a cauterant for vegetations of the labia majora and nymphæ. The patient died within twenty-four hours, probably from the toxic action of the chromic acid that had been absorbed. The postmortem showed that the kidney tissue and the liver tissue contained sodium chromate. This acute case proves that absorption of toxic doses from the surface is at least possible.

Edward Curtis and R. J. E. Scott in Wood's *Reference Hand Book*

of the Medical Sciences, 3rd edition, say that general poisoning from the continued absorption of small quantities of chromium is very questionable. They state that no *chronic* condition thus caused has been found in man.

Von Lewin (*Lehrbuch der Toxikologie*) says that chromium salts can be absorbed through wounds, from the skin and from mucous membrane. He cites the case of a boy who placed a piece of potassium bichromate, the size of a coffee bean, in his nose and went to sleep. In an hour he had developed serious symptoms of poisoning.

In Sajous's *Analytical Cyclopœdia of Practical Medicine,* 1913, vol. iii, we read that potassium bichromate when applied locally to the skin may cause dangerous ulcers, and that workmen who handle cloth dyed with solution of chromates are apt to suffer from ulcers and eczema.

Imperial Medical Counsellor Dr. Wutzdorff published in February 13, 1896, a report called "Injuries to Health Observed in Chrome Factories, and Measures Required to Prevent Them." He reviews the literature on this subject and states that the report of the chemical works Committee of Inquiry in England, which was handed to Home Secretary Asquith in 1893, states that perforation of the nasal septum is frequently followed by impairment or actual loss of smell. He carefully analyzes the whole question of perforation of the septum and of all respiratory disorders. He reports many ulcers occurring in the workers of various chemical establishments. He states that the ulcers developed not only in abrasions or cracks but also in any places where chromate dust could settle and accumulate, as between the fingers and between the toes. He found no case of depressed nose. He thinks it possible that chromate may cause chronic nephritis in some cases. The diseases of the air-passages which occur seem to be secondary to the nasal affection, but perhaps they may also be directly due to the elimination of chromate salts through the air-passages. He notes a case where a 5 per cent. solution of chromic acid was used for excessive perspiration of the feet. Violent dermatitis, with symptoms of chrome poisoning, followed. Among other regions in which ulcers have been reported he notes the external ear and the eyelids. He found no ulcer that reached a tendon or a joint. It was said in one works that the bony septum of the nose had never been affected and that tobacco is no protection from attacks. Small number of ulcers of the mucous membrane of the palate and throat were noted in workers in one of the works. He discusses at length the causal relationship the work in manufactories bears to health and says that the vapor arising from hot chromate solutions contains chromates. He then sets forth the procedures

to be undertaken to prevent injuries to health, insisting particularly upon the maintenance of cleanliness among the workmen and that when any chromate affection develops, the workman must be excluded from this work while the trouble lasts.

REPORT OF CASES PERSONALLY OBSERVED

One of us (Da Costa) has seen 44 cases altogether, 19 of which are here presented. Of the previous 25 there are no detailed records. Of the 44 cases, 5 worked in dye houses, 4 handled chromium hides, 2 worked in chemical works, 1 handled dyed cloth, and the balance were tanners. We are of the opinion that now and then a man who is wearing stockings containing dye fixed by chrome develops a genuine chrome ulcer of foot or toe. We have seen ulcers on the feet presenting all the ear marks of chrome ulcer and obviously due to recent local irritation, the victim never having worked in chrome. A prolonged case resembles the trophic or perforating ulcer of locomotor ataxia.

Of the 19 reported cases only 2 were Americans; the others were chiefly Italians, Austrians and Russians. This does not show any race predisposition or immunity. It simply shows how extensive is the invasion of our protected industries by foreigners. The ages were from sixteen to fifty-five. The period during which they had worked in chromates was between two months and eighteen years. Practically all the old workmen (seven cases) showed scars of previous ulcerations. One worked in chrome thirteen years and one four and a half years before developing an ulcer. The most common situation was in the folds of the dorsal surface of the fingers over or near the knuckles (Figs. 1, 2 and 3), but in one case we found ulceration on the palmar surface just below the metacarpal phalangeal joints (Fig. 4); two on the back of the hands; two on the dorsal surface of the forearm; one in the interdigital folds; one on the side of the last digit of the finger; one on the front of the knee; one at the edge of the nail (Fig. 5); one on the outer surface of the wrist; one on the back of the forearm, etc. In the old group of cases one was on the body near the groin and one on the inner surface of the prepuce. In such situations an ulcer is probably due to scratching with contaminated hands.

In practically all cases the ulcerated part had been kept wet by chromate solution. In one case several of the finger nails were lost several times in succession. The nails reformed with fair rapidity after the loss, which was quite painless. This man has no symptom of any disease of the spinal cord or nerves. In one case a finger was lost after perforation of a joint (Fig. 3).

Duration of the cases we saw varied from a few days to seven months. The duration is indefinite. In fact, healing is not to be expected while the work is continued, unless the part is kept really covered by impervious gloves.

The chief characteristics of ulcers are induration, pain, and a tendency to deep penetration.

The longer the duration of the ulcer the greater the induration and the greater the ulceration. One of our cases reached a tendon, one entered a joint, and another reached the bone. Seven of these cases were single, twelve of them multiple. In several of the cases there were several ulcers and in one of the cases there were many ulcers. One case had nine ulcers. One of the cases of forearm involvement had a great number of small ulcers, apparently arising in hair follicles.

A number of writers have maintained that to develop an ulcer one must have first an abrasion, a fissure, a scratch, a wound, or a crack. The great majority of our cases presented some such antecedent condition but not all. In two of the cases the condition started in the hair follicles of the forearm, which part was frequently wet with the solution. In the one case ulceration began in the hair follicles of the dorsum of the hand. In the ulcer of the front of the knee (Fig. 7), the knee was constantly wet with the chrome solution but was not excoriated before ulceration. This ulcer became seriously infected and sloughed extensively. One started in an area of prickly heat and one began in an insect bite. The workman could always tell if the ulcer had started in an excoriation, because if there was such a break of continuity he felt severe sticking pain the moment the hand entered the chromate solution. While working, all ulcers will be violently painful. Most of them are very painful even when not working, particularly when exposed to cold, even slight cold. One of our cases kept his hands in his pockets, even in summer, to avoid draughts. Only one of our cases was free from continual pain. All are tortured by itching, especially at night. The patients are usually oscillating between the Scylla of pain and the Charybdis of itching. Warmth aggravates itching and cold, pain. Pain may be so severe as to seriously interfere with sleep. It is a burning pain with violent exacerbations. The ulcer will never heal while the man is working, if he does not wear rubber gloves, and it may last months or years. It usually takes weeks to heal even when work is stopped.

As previously stated, the ulcer usually begins in an excoriation, but this is not the invariable rule, as it may start in hair follicles or in an area of skin infection, for instance, eczema, acne, or in an area of

FIG. 1.—Scars of chrome ulcers.

FIG. 2.—Chrome ulcer on dorsal surface of second finger.

FIG. 3.—Amputation as the result of chrome ulcer eating into joint. Active chrome ulcer present now.

FIG. 4.—Chrome ulcer on palmar surface of ring finger, over articulation; healed ulcer on thumb.

FIG. 5.—Scar of chrome ulcer on dorsal surface of distal phalanx of second finger near nail.

FIG. 6.—Chrome ulcer of index finger over an articulation.

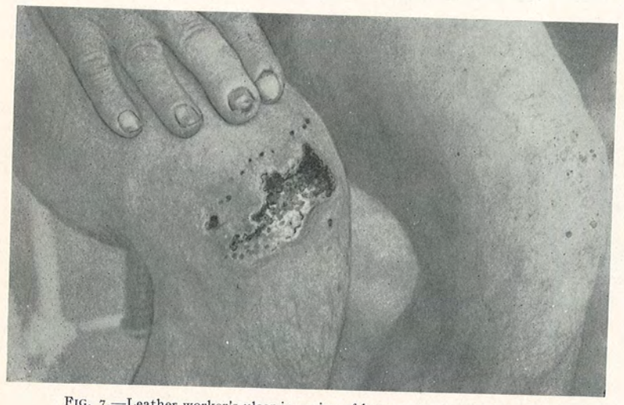

FIG. 7.—Leather worker's ulcer in region of knee area; severely infected.

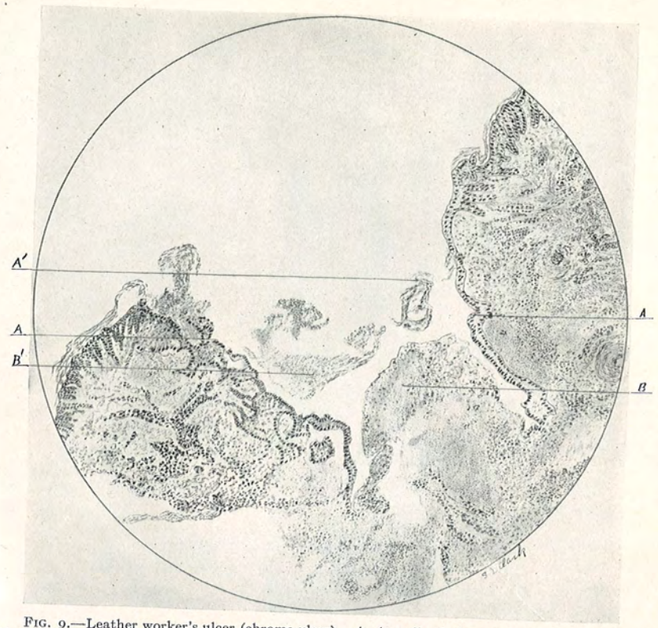

FIG. 9.—Leather worker's ulcer (chrome ulcer). *A*, *A*, walls of ulcer covered with epithelium; *A′*, island of cornified epithelium; *B*, floor of ulcer; *B′*, slough from floor of ulcer. Ulcer was 2 cm. in length, 1 cm. in width and almost 1 cm. in depth. The edges were very jagged and irregular, black in color, with induration. The floor of the ulcer was black in color, and in gross appearance contained what seemed to be masses of granulation tissue. The skin immediately adjacent to the ulcer was apparently normal, and presented areas of thickening. Sections were cut and stained with hæmatoxylin and eosin, hæmatoxylin and Van Gieson, with polychrome methylene blue; by Gram-Weigert and plain Gram technic. Histological study shows the ulcer to be clean cut and the edges lined or covered with stratified squamous epithelium. This cellular layer extends down to the floor of the ulcer and is apparently hypertrophied, as evidenced by the extensions into the connective tissue of the skin. In one area in the specimen is an isolated "island" of cornified epithelium (*A′*), evidently clipped off from a papilla of the skin. The floor of the ulcer is made up of nests of polynuclear leucocytes, areas of hemorrhage and cellular debris. Sections of sweat glands, or sebaceous glands, and of hair follicles are present, and in the immediate vicinity of these structures are accumulations of polynuclear leucocytes and some few round cells indicating a marked inflammatory condition. Irrespective of the structures above mentioned marked leucocytic infiltration is seen throughout the specimen and the blood-vessels all show marked thickening of the walls, some showing leucocytic infiltration between the coats. Recent as well as old areas of hemorrhage are present, some being immediately beneath the epithelium, while others extend down to the floor of the ulcer. When examined with the high-power objective numerous cells (leucocytes) are observed which contain pigment granules, brownish or brownish-black in color, especially in the areas of hemorrhage, while in one or two areas accumulations of these granules appear to follow minute capillary vessels. Bacteriological examination shows Gram-positive micrococci arranged in pairs and chains. No other organisms were observed. Results of inoculations from ulcers: Inoculations were made upon plain agar and into deep tubes of litmus lactose agar. These deep tubes were placed in an anaërobic condition. Of twelve cases studied, staphylococci (aureus or albus) were recovered in nine cases. Both aureus and albus were encountered in three cases. The bacillus proteus vulgaris was isolated in one case; a diphtheroid bacillus and the staphylococcus pyogenes albus in one; while the sarcina lutea and B. megatherium were observed in another. (These two latter cases were undoubtedly contaminations.) There was no difference in results obtained in the anaërobic condition. In one case no growth occurred.

FIG. 8.—Leather worker's ulcer with infected finger.

prickly heat. The ulcer is usually circular in shape, but, if it starts in a wound or fissure, has the shape of that breach in continuity. Its characteristic features are pain, induration and deep penetration. A raw, painful and tender spot is noted which enlarges little, if at all, laterally but which deepens day by day and becomes surrounded by a wide zone of induration. The ulcer may be a mere speck, may be a quarter or a half inch in diameter, or in exceptional cases, when severe pyogenic infection occurs, as large as the one shown on the knee in Fig. 7. A green or grayish core or slough forms in the centre. This becomes loose at the sides and becomes movable from side to side but long remains attached in the depths. In the deeper cases it is attached to a tendon sheath or to the periosteum. The ulcerated area with its surrounding induration moves with the skin until the ulcer reaches tendon sheath or bone and it then becomes fixed.

We had no case of perforation through a hand or forearm such as the early writers speak of as occurring in chemical works, but we have had one case of perforation into the second phalangeal joint of the ring finger of the right hand, which caused the loss of the finger (Fig. 3).

When the slough separates the discharge lessens and the healing begins from the periphery. During healing the edges seem to shrink and to reach a lower level than the ulcer or than the exuberant granulations which sometimes protrude from the sore. An ulcer may make abortive attempts to heal. It may heal on the top so that a cavity remains in the indurated area, a cavity which is roofed in and contains seropus. This may occur over and over again. The formation of a crust is usually an indication that healing is beginning. The workmen all regard it as having this significance. The edges of the ulcer are usually perpendicular and remain so unless severe pyogenic infection arises. In nearly all cases the parts about the ulcer are densely hard. This indurated area is seldom narrow. It is usually one-eighth of an inch broad or even more. If the ulcer is not very deep the indurated area moves with the skin. The more superficial the ulcer the more movable it is and the less the induration. The deeper the ulcer the less movable it is and the greater the induration. When the ulcer extends to tendon sheath or periosteum it is entirely fixed.

The floor of the ulcer is pale pink or pale gray. It shows no granulations until the slough is loose or separated. The discharge is usually thin, scanty and purulent; being commonly yellow in color, but sometimes colorless. In some ulcers there is practically no discharge observed on dressings. A little can always be found by squeezing. In one case of severe infection there was a profuse watery discharge.

The area around the ulcer is usually markedly red for a short distance and may be œdematous (Fig. 8). Some cases are bright red for a quarter of an inch about the ulcer. This means that the ulcer is not healing. The parts near about a healing ulcer are pearly white. It is not unusual to find eczema in this region. The scar which forms eventually becomes soft and loses much of its hardness as time goes on. It becomes markedly depressed, is not tender and, though first of a brownish hue, becomes pearl white. It is usually smooth but may be corrugated. In only one of our cases was there marked swelling of the hand. In this case there was cellulitis. The hand was greatly swollen and red lines of lymphangitis showed on the forearm and arm. This was the one case in which related glands were involved. In no case were there any constitutional symptoms to suggest general poisoning by chrome, and in no case were there signs of perforation of the nasal septum, ulceration of the larynx or respiratory disturbances.

Fig. 9 shows a microscopical study of a chrome ulcer and the legend contains the bacteriological report by C. Rosenberger and his description of the ulcer.

The workmen adopt various means to prevent these chrome sores when they have any excoriations upon the hands. Some wear finger tips of rubber, some apply waterproof court plaster, some apply collodion, some rub their hands with oil before putting them in the chrome salt, some wash them in a solution of carbonate of sodium on ceasing work. As a general thing the workmen use some salve for the abrasions but some workers maintain that any ointment does harm. It has been my custom to treat the cases during the progressive stage by washing them first with carbonate of sodium and then several times a day with peroxide of hydrogen and dressing them with lead water and laudanum.

Hot-water bags are used for pain. Soaking in hot lead water gives relief. Surgical removal of the slough does harm. The manufacturers maintain that the condition will seldom arise if the workman is careful to clean his hands and that he will have no severe trouble if he will stop work when he has an abrasion. Many of them dwell on the notorious carelessness of workmen. One manufacturer wrote me that oiled hands were a great protection. He also stated that similar sores occur from hydrochloric acid, from lime and from sulphide of sodium, and says that carbonate of soda has long been recommended as a wash for chrome stings.

Isaac Tyson, of Baltimore, recommended that the sore be painted once with a solution of nitrate of silver in order to form insoluble

chromate of silver. Chevalier, Sr., and Bécourt recommended dressing with weak lead acetate and dilute alcohol and have stated that soaking in dilute lead water for four or five minutes will relieve pain and enable the patient to get sleep.

We have received the following important communication as to the prevention of chrome sores among tannery workers. It was sent us by Dr. Louis Levi, Chief Chemist to the Pfister and Vogel Leather Company, Milwaukee, U. S. A. He says that chrome sores tend to become very painful and eat very deeply. He has tried all kinds of alkaline and neutral ointments for the cure of this disease and without success. He therefore determined to try and find some means of prevention. He has prepared a very efficient ointment which he has now been using for a year and the cases have dropped from four to six a week to two in six months.

He orders that the ointment be applied twice daily. Three parts of petrolatum are mixed with one part of lanolin. This mixture is melted on a water-bath or stove and when melted and thoroughly mixed, ten to fifteen drops of 90 per cent. carbolic acid are added to every 400 grammes of the mixture. This represents five drops of acid to four grammes of ointment. The material is placed into a glass or earthenware jar and allowed to solidify until ready for use. The workman cleanses his hands and arms thoroughly with soap and water, rinses with warm water and, while the parts are still moist, applies the ointment. He rubs it over the whole exposed area for about two or three minutes. He then takes a clean cloth and wipes the skin entirely dry. Doctor Levi says that the lanolin is absorbed by the skin and that the petrolatum forms a light coating on the surface. The petrolatum will keep most of the chrome away but, should this outer coating of petrolatum wear off, the lanolin in the skin will still prevent the action of the chrome. Doctor Levi published this method in the *Hide and Leather Review,* London, England.