ON THE PATHOLOGY AND CLINICAL HISTORY OF SOME RARE FORMS OF BONY ANKYLOSIS.¹

By HOWARD MARSH, F.R.C.S.ENG.,
Surgeon to and Joint Lecturer on Surgery at St. Bartholomew's Hospital;
Consulting Surgeon to the Hospital for Sick Children.

Nor many years ago all that was taught about bony ankylosis could be summed up in two propositions: (A) That the only manner in which a joint could recover after it had been involved in suppuration was by the development of bony ankylosis. (B) That there was only one cause for bony ankylosis, namely, suppuration. It is now known that neither of these propositions is correct. (A) Suppuration is not necessarily, either in acute or chronic cases that recover, followed by bony ankylosis. This is illustrated in regard to acute cases, in pyæmia, acute suppurative arthritis following wounds, the acute arthritis of infants, and in other instances. In all these conditions, if the joint concerned is freely opened, irrigated, and drained aseptically, perfectly free movement may be preserved. Sometimes, if a joint distended with pus, as the consequence of pyæmic infection is merely evacuated by aspiration, complete repair follows. Generally, however, when acute suppuration involves a joint, unless efficient treatment is at once employed, ankylosis will take place; but then, in the majority of cases, it will not be bony but fibrous in its character. Undoubtedly some of the most complete examples of bony ankylosis that can be found are those which have followed acute suppuration. But the point I wish now to emphasise is that bony ankylosis does not necessarily, or even commonly, follow acute suppuration. In chronic cases attended with suppuration bony ankylosis, instead of being the rule, is quite the exception. Thus, in tuberculous disease—for example, of the hip or the knee—should ankylosis follow, this, in the great majority, will not be bony but fibrous. (B) Bony ankylosis often occurs in joints quite independently of the suppurative process. It is to this part of the subject that I wish to invite particular attention. Bony ankylosis, apart from suppuration, is met with in the following groups:

1. *In Tuberculosis.*—All are familiar with four results of tuberculous joint disease: (A) Perfect recovery when treatment is adopted early, and is adequately carried out. (B) Fibrous ankylosis; this, in a degree which varies widely in different instances, is very common. (C) Bony ankylosis after suppuration—as is seen, for instance, sometimes after hip disease. (D) Complete destruction of the articulation, calling for excision or amputation. But there is a fifth group. (E) In this group inflammation is from the first plastic, and is followed by the development of complete synostosis. In these cases the inflammatory process is never active. There is little, if any, alteration of the articular ends, and the usual symptoms of inflammation—swelling, heat, and pain—are so little marked that the condition of the joint may for some time entirely escape notice.

CASE I.—A girl, aged 11, in bed with Pott's disease, was found to have her elbow completely stiff. She had complained of no pain, and the only thing her mother had noticed was that she used the limb awkwardly in feeding herself. On examination the elbow-joint presented a natural appearance, but it was completely stiff, and the muscles were wasted. The stiffness proved to be permanent.

CASE II.—A girl, aged 9, had tuberculous disease of her knee. There was some synovial swelling, accompanied by flexion and slight heat. Leather splints were applied. Heat and swelling gradually subsided, but the joint became completely stiff. The child has now been using the limb freely for the past five years, and the knee is still quite fixed.

I believe that in both these cases bony ankylosis has occurred. Of course there is no proof of this without maceration of the specimens, and examination of them in longitudinal section; but that bony ankylosis may occur in such instances is proved by the following example.

CASE III.—The elbow-joint of a girl, aged 14, had gradually, without symptoms, become fixed at an angle of about 130°.

To improve this position Dr. Walter Roughton, of New Barnet, performed excision. During the operation he found that complete bony ankylosis had taken place. (See Fig. 1.)

Fig. 1.—The elbow-joint seen in longitudinal section. The humerus and olecranon are completely synostosed.

This specimen is of great value. It is the only one of its kind that I have seen.

I have met with several instances in which tuberculous joints have become thus quietly completely stiff. It seems important to bear these plastic cases in mind. I know of no method by which bony ankylosis can be averted. It takes place, as the above examples show, whether or no splints are used, but should it occur while the limb is in splints the patient and his friends will ascribe it to the treatment that has been adopted.

I believe that this plastic form of tuberculous inflammation may also involve the spinal column. Fig. 2 shows two

Fig. 2.—Complete bony ankylosis between the bodies and neural arches of the second and third cervical vertebrae (No. 1078, Museum of St. Bartholomew's Hospital).

¹ Read in the Section of Surgery at the Annual Meeting of the British Medical Association held in London, July-August, 1895.

cervical vertebræ very firmly ankylosed. They are not altered in shape, or eroded even superficially. No history of the specimen is known; but I believe the condition has resulted from tuberculous inflammation, followed by the organisation of the inflammatory products into bone.

2. I would now ask whether bony ankylosis occurs in Charcot's disease, apart from suppuration attending perforating ulcer? The great majority of observers, I believe, would answer in the negative. Yet, I think, there is evidence to throw some doubt on this conclusion.

Charcot² has described a tabetic foot in which the under surface of the astragalus presented bony vegetations. The scaphoid and cuboid were scarcely recognisable, and the internal cuneiform was fused with the first metatarsal, and the middle cuneiform with the second metatarsal bone. All the tarsal and metatarsal bones were spongy and friable. Charcot remarks that these complex lesions, occurring apart from traumatism and suppuration, can only be classified as definite osseous and articular changes accompanying tabes.

Fig. 3.—Bony ankylosis of the foot (Museum of the University of Cambridge).

Fig. 4.—Bony ankylosis of the foot. Some of the tarsal joints are obliterated, but others are but little changed, and ankylosis is due to the formation of plates and vegetations on the surface of the bones (Museum of the University of Cambridge).

Figs. 3 and 4 represent two remarkable skeletons of feet, kindly lent to me by Sir George Humphry, from the Museum of the University of Cambridge. These feet are the seat of almost universal bony ankylosis, owing to the fact that the superficial surfaces of the different bones are covered with vegetations and continuous bony deposits, which bridge over the intervals between them. On section, however, it is discovered that some of the tarsal joints themselves are very little changed. Their cavities can still be traced, and even the articular cartilages can be recognised. Some of the tarsal and phalangeal joints, however, have undergone such complete synostosis that no vestige of their cavities remains. The history of the cases from which these specimens were derived is unfortunately unknown. I have never seen such conditions before. How are the appearances to be explained? At first sight they might be attributed to suppuration—possibly of septic origin. But, in the first place, there is very little alteration in shape, and very little erosion of the bones,

such as would be expected in widespread suppuration; secondly, many of the joints are but little changed; yet in septic cases it is upon the joints themselves, through their synovial membranes, that the main stress falls; thirdly, the sesamoid bones of the great toe are much increased in size—a change that, so far as is known, could not be produced merely by inflammation going on to suppuration. The complete bony ankylosis which is present in some of the phalangeal joints is a condition that may follow suppuration. But here, again, the bones are not eroded or altered in shape; they are simply synostosed. The formation of osteophytic outgrowths and low buds and vegetations, which is so marked a feature in these specimens, and which was present in Charcot's case, is well shown in a tabetic foot in the Museum of St. Bartholomew's Hospital (No. 691E). In this specimen, although no suppuration had occurred, the tibia and the fibula are ankylosed together by bone. These examples appear to show that bony ankylosis, apart from suppuration, may occur in Charcot's disease.

3. In a case in which the median nerve had been divided and the hand had become clawed, Mr. Bowlby found³ that bony ankylosis had occurred in one of the interphalangeal joints of the ring-finger, while several of the other finger-joints were stiff, although as yet ankylosis had not taken place. This specimen is the only example of bony ankylosis after nerve-section that I have met with.

4. It is well known that in gout and (5) gonorrhoeal rheumatism bony ankylosis occurs entirely apart from suppuration.

6. In some instances severe contusion of the articular surfaces of a joint may be followed by bony ankylosis. I have seen this result follow in the temporo-maxillary joint after a heavy fall upon the chin.

7. Bony ankylosis is not very uncommon in the spine in the more extreme forms of lateral curvature. It has occurred in specimens No. 2103 and 2104 in the Museum of the College of Surgeons and in 252 and 254 in the Museum of St. Thomas's Hospital. The vertebræ are fused together in the concavity of the curve. Similar examples may be found in almost every large pathological museum.

8. I now pass to a group of cases in which multiple bony ankylosis has occurred where no suppuration has taken place.

CASE IV.—In 1889 a groom, aged 22, was admitted into St. Bartholomew's Hospital. Four years before he was said to have had rheumatic fever, for which he was in bed for thirteen weeks. At the end of this time he was able to walk, but his joints gradually became stiff, and for three years he had been bedridden. On his admission the hips and knees were flexed, and the feet were in a position of talipes equinus. All the joints of the lower extremities were firmly fixed. His remaining joints were all free. Beginning with the right limb, I performed, on successive occasions, in order to remove deformity, osteotomy of the ankle, excision of the knee, and osteotomy of the femur below the trochanters. After the last operation the wound suppurated. He was at the time in very poor general health, and, developing lardaceous disease, he ultimately died of exhaustion. All the six large joints of the lower extremities proved to be ankylosed by bone.

CASE V.—Dr. Hilton Fagge relates the following instance.³ A man, aged 34, was admitted into Guy's Hospital in 1874. In the previous year his spine became stiff, and formed a rounded curve; later the right hip became fixed. He died of chest troubles following difficulty of respiration. At the *post-mortem* examination the arches and the spinous processes of the dorsal vertebræ were found completely ankylosed, and so were the articular processes (Fig. 5). The vertebræ were much softened, and could be cut with a knife, and the spine had become fractured in placing the body in the shell. The ribs were firmly and extensively ankylosed to the vertebræ. The right hip was also ankylosed.

CASE VI.—Dr. Griffiths, of Cambridge, has given me notes of the following case. Three years ago a woman, aged 20, had the first phalangeal joint of the index finger swollen and painful. Pain and swelling after a time subsided, but the joint was left ankylosed. Other finger-joints underwent similar changes, then the wrists, and later the elbows swelled and were painful, and they also ultimately became quite

³ St. Bartholomew's Hospital Museum.
Path. Soc. Trans., vol. xxviii, 1877, p. 203.

² *Progrès Médical*, 1882, p. 606.

stiff. In an attempt to improve the position of the left elbow the bone was fractured. At the present time several finger-joints, both wrists, and both elbows are quite stiff. Some other joints are rather swollen, but in several Dr. Griffiths finds no swelling, no nodules, and no thickening of the bones. The ankles are swollen, but movement in them is free. The knees are somewhat swollen and stiff, other joints are natural.

I have mentioned that bony ankylosis may occur in the spine in tuberculous disease, in lateral curvature, and, in such cases as that recorded by Dr. Fagge.

Fig. 5.—Dr. Fagge's specimen of bony ankylosis of the spine (*Trans. Path. Soc.*, vol. xxviii, p. 203).

Fig. 6.—Ankylosis of the spine produced by ossification of the anterior common ligament (Museum of the University of Cambridge).

9. It is well known that bony ankylosis is also common in the spine in Osteo-arthritis. On examining specimens illustrating this condition—and they can be found in any large museum—it is seen that the ankylosis is produced either by (a) ossification of the anterior common and other ligaments (Fig. 6), or (b) by the formation of buttresses of bone passing from one vertebra to another (Fig. 7). In many instances the ribs are firmly ankylosed to the bodies

Fig. 7.—Ankylosis of the spine produced by the formation of bony buttresses (Museum of the University of Cambridge).

and transverse processes of the vertebrae by ossification of the costo-vertebral and costo-transverse ligaments.

On making a longitudinal section of the spinal column, it is found that the ankylosis is entirely limited to the external surface of the vertebrae. The spaces between the bodies, which are occupied by the intervertebral discs, are seen in dried specimens to be in no way encroached upon. It will thus be observed that bony ankylosis, apart from suppuration, may occur in the spine, as in the limbs, in three different ways: (a) by direct and complete fusion of the component bones (Fig. 5, Fagge); (b) by ossification of the ligaments (Fig. 6); and (c) by the development of bony buttresses or plates, the joints remaining unaffected (Fig. 7). I may add that bony ankylosis may involve the spine only, or the spine may be involved in common with the limbs.

I have ventured to bring these different forms of bony ankylosis without suppuration under the notice of the meeting, first, because it may be useful to collect and arrange them for clinical study; and secondly, in the hope that those who take part in the discussion may throw some light on their pathology. The examples I have related seem to show that bony ankylosis is sometimes a reparative and sometimes a degenerative process. When it occurs in acutely inflamed joints, for example in the course of pyæmia or of acute suppurative arthritis following a punctured wound, bony ankylosis is reparative, and closely resembles the union of a fracture. It is reparative also when it occurs in tuberculous disease of the joints or spine. In all these instances inflammatory exudation is converted into normal bone to the advantage of the individual concerned. In other cases bony ankylosis is associated with and is a part of wide degenerative changes in the structures involved. In Fagge's case, as already mentioned, the vertebrae could be cut with a knife, and the spine had been fractured while the body was being lifted to place it in the shell. It was degenerative in the case recorded by Charcot and in the feet lent by Sir George Humphry. It is degenerative, again, in gout, and after nerve injuries, as well as when it is multiple, as in Case IV. It must be termed degenerative also where it replaces the normal structures by a tissue which is inappropriate for the discharge of the func-

tions of the part, for example, in ossification of the ligaments of the spine, and of the joints and ligaments of the ribs.

The true pathology of many forms of bony ankylosis, such as those illustrated by Cases iv, v, and vi, is at present, I believe, unknown.

I will not occupy the time of the Section by entering at any length on the clinical aspect of cases of bony ankylosis. I will only enumerate four propositions: 1. Whenever this condition seems likely to occur, great care should be taken to keep the joint concerned in a useful position. 2. We know of no means by which a threatened bony ankylosis can be averted. 3. The use of passive movements cannot prevent bony ankylosis. Indeed, by maintaining irritation and promoting inflammatory exudation, it is likely to produce a directly opposite result. 4. When bony ankylosis has occurred, excision or osteotomy may be freely employed, in order to correct any deformity that has taken place, for by methods that are now available these operations are attended with scarcely an appreciable risk.

[The author is indebted to Messrs. Cassell and Co. for permission to reproduce these illustrations from his work on *Diseases of the Joints and Spine* (Cassell and Co., 1895).]

Mr. TARGETT laid stress on the distinction between ossification of the vertebral joints and of the ligaments, comparing the latter to myositis ossificans. He had never seen ossification in Charcot's disease without previous suppuration, that is, perforating ulcer. The disease was almost always attended with atrophy of bone, which was not shown in the specimens exhibited. He therefore doubted whether Charcot's disease was present in these cases. The most rapid and complete ankylosis without suppuration was found in puerperal fever and other kinds of sepsis. Dr. Fagge's case may have been one of quiet tuberculous ankylosis, since there were tuberculous deposits in the mesenteric glands.

Mr. BOWLBY remarked that in one of the feet shown there had undoubtedly been suppuration, which, however, was far anterior to and quite independent of the ankylosis. The case was one of undoubted tabes. In his case of ankylosis following injury to the median nerve there was partial ankylosis of all the joints of the hand. After nerve injuries the joints supplied by them undergo changes somewhat like those in acute rheumatism, becoming swollen, tender, and partially ankylosed. These changes are not, as a rule, permanent, but there may be a deposition of fibrous tissue in the ligaments, particularly on the flexor surface of the hand, often leading to permanent stiffness. He agreed with Mr. Marsh's division of bony ankylosis into degenerative and reparative. He also pointed out that many joint lesions were due to disease of the central and peripheral nervous system, such as syringomyelia and disseminated sclerosis, and said that in the near future osteo-arthritis would probably be shown to have the same origin. Mr. Bowlby believed that many cases of bony ankylosis without suppuration lie latent in museums through having no histories attached.

Mr. BLAND SUTTON refused the title of quiet tuberculous as applied to the axis and cervical vertebrae shown by Mr. Marsh, on the ground that the time of life was too late. Similar specimens, with the occiputs joined on, were to be found in most museums. Many had been turned up in graveyards, and one was found in a mummy from the Pyramids. The condition was not thoroughly explained in all cases, but Mr. Arbuthnot Lane had suggested that the skeletons were those of costermongers and others accustomed to carry weights on their heads. Mr. Sutton had confirmed this in the case of the Paris oxen, which are yoked by the horns. He also pointed out that in the veterinary museums at Alfort and Camden Town there are numerous skeletons of horses showing ankylosis due to ossification of the anterior common ligaments and ligamenta subflava. This may cause snapping of the vertebral column in horses cast for operation.

Mr. ELLIS (Gloucester) referred to the condition known as hallux flexus, rigidus or dolorosus, which he considered due to the outward pressure of the median-pointed boot pressing the great toe under the adjoining ones. The joints most exposed to irritation are most subject to this disease, and ankylosis is here reparative.

Mr. MARSH, in answer to Mr. Bland Sutton, said that in his experience tuberculous disease of the spine might occur

with well-marked angular curvature up to the age of 70, and he had heard of it at 90. Ankylosis of the spine from ossification of ligaments was more than a pathological curiosity in man; if it was complete the patient was very helpless; and when it was associated—as was often the case—with ankylosis of the ribs, it was very likely, if bronchitis or pneumonia occurred, to interfere with respiration so seriously that the result was fatal.

ON SPLENECTOMY, WITH NOTES OF THREE CASES.¹

By W. D. SPANTON, F.R.C.S.ENG.,
Surgeon to the North Staffordshire Infirmary.

I HAVE now performed the operation of splenectomy three times—two of the cases being followed by a fatal result, one by recovery—and they are sufficiently typical to afford an opportunity to consider the subject in its general aspect, and to endeavour to deduce from them some observations of practical importance. It is only during the last few years that the propriety of such an operation has gained favour. In this respect the operation stands by no means alone, for almost all formidable surgical procedures have had to pass through a similar ordeal, and it is only by experience that we are enabled to eliminate cases unsuitable for operation, and to perfect our methods of performing it so as to render it at the same time justifiable and reasonably safe. The records of the cases are as follows:

CASE I.²—Mrs. S. B., aged 47, married, admitted into North Staffordshire Infirmary under Mr. Spanton, September 1st, 1883. Patient always strong, no illness until the present. Twelve children, all living, youngest 4 years old. Never been abroad, and never lived in ague district. Illness commenced two years ago with pain and enlargement on left side of abdomen. She thought at first that she was pregnant. The pain has never been very acute, but chiefly of a dragging character.

The enlargement of the abdomen increased gradually, and twelve months ago she became an in-patient in the medical wards on account of the inconvenience it caused her. At that time she was able to get about to do her household work, and was fairly stout and strong.

The tumour then was very distinct, and had all the characters of an enlarged spleen. It extended to within about 1½ inch of Poupart's ligament; in fact it covered nearly half the abdomen. Since leaving the infirmary she has been under medical treatment outside, but without any benefit resulting.

There had been no ague fits or any attacks of that nature before her first admission, but during the last few months she has sometimes felt cold, which has been followed by a free perspiration. For the last twelve months she has lost flesh rapidly and has got so weak that she cannot get about to do anything. Digestion fairly good, no sickness, no marked anaemia, catamenia absent for about twelve months.

Urine contained phosphates but no albumen. Blood examined under microscope was found to present no marked deviation from a normal specimen; the white corpuscles were not increased and the red ones were well formed. The patient had an anxious expression, appeared much troubled about her complaint, and was prepared to submit to any operation. She suffered from severe pain in the head and in the abdomen while in the infirmary, and the temperature varied from 100° to 103°F. She had no distinct shivering attack but perspired much when the pain was most severe. A consultation was held and it was decided to operate, but on account of her condition it was thought advisable to postpone it until the temperature had subsided.

On September 11th she seemed much better, the pain was less and the temperature was only 99°F. It was therefore arranged for the operation to take place on the following day.

The patient was removed to Victoria Ward on September 12th, but no purgative was given and no enema administered because a few days before she had a tendency to diarrhoea.

¹ Read in the Section of Surgery at the Annual Meeting of the British Medical Association, held in London, July-August, 1895.

² This case was briefly reported in the BRITISH MEDICAL JOURNAL, 1883.