A Lecture
ON
OLD UNREDUCED DISLOCATIONS OF THE SHOULDER-JOINT,

INCLUDING FIVE HITHERTO UNPUBLISHED CASES OF OPERATIVE TREATMENT, IN ONE OF WHICH GOLD PLATE WAS BURIED FOR 40 DAYS.

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GENTLEMEN,—Dislocation of the shoulder-joint is the commonest of dislocations and one of the most liable to remain unreduced. This liability may be explained in the following way. The joint is thickly covered with both muscle and fat in the middle-aged males who are most liable to this injury, so that when swelling supervenes a wrong or doubtful diagnosis is apt to be made. The patients are not infrequently alcoholic and therefore careless of their persons and dilatory in reporting themselves to their medical attendant or in presenting themselves at hospital. The injury is not always a very painful one. Possibly one reason why it is sometimes confounded with fracture is that it usually is complicated with some minor fracture, especially with fracture of the greater tuberosity of the humerus. We have learnt this from the practice of operating on unreduced dislocations and also from the use of the x rays. The great majority of these dislocations are subcoracoid and it will be remembered that their reduction is usually attempted either by extension combined with leverage obtained by using the surgeon's foot or fist as a fulcrum or else by manipulation, using the attachment of the coraco-humeral ligament to the edge of the glenoid cavity as a fulcrum and often also combining with the manipulation extension applied to the upper end of the arm and at right angles to its long axis so as to prize the head of the humerus from beneath the coracoid or the clavicle. And it is not uncommon to combine with any method direct pressure with the fingers over the head of the humerus with a view to pushing it into the glenoid cavity.

The most justly popular of the manipulation methods is Kocher's and there is no better extension method than that known as Astley Cooper's—namely, with the heel in the axilla. Kocher's method, as is well known, is based mainly on the consideration that the upper and outer part of the capsule, including especially the strong bands which extend from the coracoid process to the humerus on each side of the bicipital groove, remains untorn. In order to relax this the upper arm is rotated strongly outwards. Previously, in order to bring the head of the humerus firmly against the edge of the glenoid, the elbow is pressed against the flank and, in resistant cases, backwards and towards the spine as well. Then the arm is raised in an antero-posterior plane up towards the front of the shoulder. The head of the humerus ought then to have been by these manipulations levered into position on the edge of the glenoid opposite the rent in the capsule and ready to slip into place as soon as the humerus is rotated inwards. Measures like these frequently succeed in old dislocations as well as in new, especially if they are used with skill, patience, and perseverance. (Great force should not be employed on account of its dangers.) Thus Kocher reduced 12 out of 13 dislocations by manipulation. Their age was as follows: one of three weeks, two of five weeks, three of seven weeks, four of three months, and two of four months. Other surgeons do not seem to have been quite so successful, though Kocher's pupil, Ceppi, says that one can reduce an old as easily as a recent dislocation. It is difficult to avoid a slight feeling of scepticism, especially when one has inspected the interior of an old unreduced shoulder-joint. The usually accepted limit for even attempting reduction of dislocated shoulders has long been three months. It is well known that success has occasionally followed attempts on much older cases, but only rarely. And many dangerous accidents have resulted from the employment of even moderate force. No reasonable person can suppose that a very old unreduced dislocation can be freed from its adhesions and from its new capsule, and a place remade for it in the glenoid now firmly adherent to overlying soft tissues and often to fragments of bone without the exercise of force.

SYMPTOMS.

Those of an old unreduced dislocation differ in some points from those of a fresh one. Instead of swelling and effusion of blood there is wasting of the deltoid and of other muscles. The absence of the head of the humerus from the glenoid and its presence elsewhere thus become very obvious. On the other hand, in some old cases the original projection of the elbow from the side becomes lessened, but not in all, at least until a very considerable time has elapsed. In some cases time and exercises increase the range of movement of the displaced shoulder-joint, but in others time diminishes it. The freedom of movement of the scapula on the trunk tends to increase. As a rule there is no difficulty in recognising an old dislocation of the shoulder, because the absence of the head of the humerus from the glenoid can be felt so easily as well as seen. Whether or not there is also a fracture is less easy to determine, but the x rays can be of great assistance. Neither in a skiagram nor even in the course of an open operation is it always possible to be sure whether abnormally placed bone has been chipped off, torn off, or altogether newly formed.

PROGNOSIS.

The longest series of cases of old dislocation of the shoulder treated at one hospital under one surgeon with which I am acquainted is that given by J. Finckh in his admirable account of the experience of Professor Bruns in the Tübingen Clinic. It includes exactly 100 cases. In 27 of these reduction was not attempted and in 73 it was. In nearly two-thirds of these 73 it was successfully effected. Much, of course, depended on the age of the dislocation. After the ninth week failure became usual—there were only two successes out of 16. Up to the ninth week 46 out of 55 were reduced—i.e., 84 per cent.:—

In the 2–3 week were 20 cases, of which 19 were reduced	= 95 per cent.
In the 3–6 week were 24 cases, of which 20 were reduced	= 83 per cent.
In the 6–9 week were 11 cases, of which 7 were reduced	= 64 per cent.

} = 84 per cent.

I think these figures give a very just idea of the general prognosis and that Finckh sums up the position well in the following words: "If no complication coexists the prognosis of dislocations two to four weeks old is absolutely favourable, up to the ninth week very good, since up to this point of time nearly four-fifths of all the cases were reduced. Cases of longer duration than nine weeks were only exceptionally reduced without a cutting operation." I will deal with the prognosis of cutting operations when I describe them under the head of treatment.

The non-operative reduction of old dislocations is attended with the same risk of accidents as is that of recent ones. First, as regards anæsthetics, there appears to be a special danger attached to the administration of chloroform to facilitate the reduction of dislocation of the shoulder-joint. Kocher states that Marchand collected 134 deaths from chloroform, of which no less than 11 occurred in reducing dislocations of the shoulder. I seldom or never permit chloroform to be given in such cases myself. In one of the few exceptions I have permitted to this rule for many years the patient was himself a surgeon and had his own way; but in one case in which I was about to attempt reduction of a hip chloroform was given contrary to my wish and there resulted a death from anæsthesia which to the survivors, including myself, was one of the most painful catastrophes I have ever witnessed. The great majority of recent shoulder dislocations and not a few older ones need no anæsthetic at all; and if one is required gas or ether should be given. If the patient struggles when the reduction has commenced one of two courses should be adopted: (1) either the surgeon should proceed without any more anæsthetic at all being administered, hoping to effect the reduction quickly; or else (2) he should desist altogether and the anæsthetist, carefully avoiding all hurry, should patiently and watchfully get the patient well under. I give this advice because many

deaths from anæsthetics have occurred in the following way. The patient has shown signs of consciousness as soon as the surgeon, commencing to operate, has touched some sensitive tissue or organ. The anæsthetist has then attempted to hurry the patient into a state of profound anæsthesia. The breathing has gone wrong or ceased a second or two before the anæsthetist, whom a long series of successful administrations has made unsuspicious, has realised what has happened. It has then been too late to retrieve the situation. If the breathing stops while strong extension is being used the surgeon should always desist.

Secondly, as regards *risk to vessels*. It should be remembered that serious accidents of this kind have occurred with the use of force described by reliable men like Mr. T. Holmes, for example, as moderate or even as "slight." The Tam O'Shanters and Souter Johnnies who form so large a proportion of these cases are apt to have unsound vessels, as, indeed, are more abstemious people of advanced middle age, and even in the healthiest subjects the adhesions and new fibrous tissue formed around the displaced head of the humerus frequently adhere to the axillary vessels. The great majority of old unreduced dislocations affect persons between the ages of 40 and 60 years. Another remarkable fact about these cases is that even with a perforated axillary artery there may be no loss of radial pulse at the wrist. This was observed both in Holmes's and in Callender's cases. There is also sometimes little or no pulsation of the large axillary swelling which forms and usually keeps increasing and is accompanied by pain in the arm which may become very severe and by the general signs of hæmorrhage, such for example, as pallor and restlessness. Nor is there always a bruit.

Thirdly, with regard to *injury to nerves*, minor nervous troubles such as pins and needles and numbness in the fingers occur sometimes and usually pass away, especially if assisted by rubbing and galvanism. But more serious troubles, including great pain, also occur and used to be regarded as the principal indication for operative measures which then generally took the form of excision of the humeral head. More rarely dislocation of the shoulder occurs in conjunction with such severe injury of the brachial plexus that surgery vainly attempts to afford a remedy. These terrible cases of injury to the brachial plexus or its roots more frequently, however, follow falls on the shoulder which do *not* cause dislocation. Dislocations of the shoulder, though they often are caused by falls on the shoulder, are more frequently the result of falls on the elbow or the hand. Even complete motor and sensory paralysis of the arm complicating dislocation of the shoulder is sometimes seen to pass off without operative treatment.

With regard to *complication by fracture*, the most common is that in which the greater tuberosity is broken off; the next most common is fracture of the surgical or anatomical neck. Less frequent are fractures of the edge of the glenoid fossa. I cannot give any trustworthy figures. The use of the x rays and the practice of operative reduction are showing that old figures bearing on these points are erroneous. Great œdema of the arm is sometimes seen.

With regard to the prognosis in cases of dislocation of the shoulder which remain unreduced, if observed for some years they are sometimes seen to improve wonderfully in the matter of usefulness. Not that the degree of all-round mobility of the new and abnormally placed joint becomes at all comparable to that of the old but it increases up to a certain point and is supplemented by increased mobility of the scapula. Nevertheless, the majority of unreduced dislocations of the shoulder are seen, even after many months, to inflict on their subjects great disability, especially in fulfilling the functions of the toilette. When nerves are compressed, pain and even paralyses further complicate the case and may be incurable without operation.

PATHOLOGY.

Of the changes in the relations of the bones I could not hope to equal, much less to improve upon, the description given by Sir William Flower in Holmes's "System of Surgery," second edition, vol. ii., p. 813. Writing of fresh dislocations of the common or subcoracoid variety he says: "The head of the humerus lies on the anterior surface of the neck of the scapula, immediately below the coracoid process, in front of, internal to, and rather lower than, its normal situation. That part of the anatomical neck which separates the articular surface from the great tuberosity rests upon the anterior edge of the glenoid fossa. The subscapular muscle is raised from the neck of the scapula and stretched over the front of, or above, the head of the humerus. The muscles from the back of the scapula are drawn tightly across the glenoid fossa or one or more of them may be ruptured or detached from the bone. A portion or the whole of the greater tuberosity is frequently separated, when it may be drawn into the glenoid fossa by the action of the muscles inserted into it or may be retained in connexion with the humerus by the periosteum or the capsular ligament. The long tendon of the biceps is rarely, if ever, injured. (Footnote.—As Dr. Hamilton has recently asserted that, contrary to what has been affirmed by Sir Astley Cooper, the tendon of the long head of the biceps is often broken asunder or detached completely from its insertion (op. cit., p. 535) I may mention that the statement in the text is founded on examination of numerous specimens and reports of dissections)." The truth is that the long head of the biceps is occasionally but exceptionally torn from its attachment. In all the 44 cases given in brief abstract in Reerink's collection of unreduced dislocations treated by arthrotomy or by excision this accident is not once noted. But it is significant that in the only two cases of which a *full* anatomical description is given by the same author (quoting from Jössel) the biceps tendon was torn from the glenoid cavity in one case and ended as a small fibrous band in the bicipital groove. The biceps tendon was intact in all the five dislocated shoulder-joints I have operated on myself. "The muscles that descend from the coracoid process to the humerus are stretched by the projection of the head of the bone forwards and the great vessels and nerves are displaced inwards. Occasionally the circumflex nerve is pressed upon to such an extent as to cause paralysis of the deltoid muscle," &c.

In old unreduced cases "in process of time a new shallow socket is formed upon the anterior surface of the neck of the scapula, partly by absorption of old bone and partly by deposit of new around its edge." In subcoracoid dislocations "the new cavity is formed more or less at the expense of the anterior portion of the glenoid fossa, which is gradually worn away, so that in some cases the original socket is finally almost entirely lost. A corresponding change takes place in the head of the humerus; where it rests upon the edge of the glenoid fossa absorption occurs, so that a groove is excavated, usually between the articular head and the great tuberosity. With continued friction this increases in size simultaneously with the change in the scapula; the two accommodate themselves to each other and utimately the head of the latter bone presents a double articular surface, separated by a vertical ridge, the posterior portion being part of the old glenoid cavity, the anterior the newly formed socket. These respectively articulate with the two sides of a wide groove placed vertically on the head of the humerus, and thus a rude kind of joint, which allows of a certain amount of motion, is formed." "The under surface of the coracoid process, especially near its tip, is almost always found smooth and eburnated, having entered into the formation of the new articulation."

The above changes in the glenoid and in the humeral head do not take place in intracoracoid dislocations, and in subglenoid cases the scapular new articular surface is formed "on the upper part of the anterior border of the inferior costa of the scapula, encroaching considerably upon the lower and anterior part of the glenoid fossa" (Flower).

This does not by any means end the account of the salient anatomical features of an old unreduced dislocation of the shoulder. The new joint, as seen in an open operation, is not so much the result of absorption as of new formation. In or near its edges, or parts of them, is found new bone, often in the form of separate osteophytes. The cavity is deepened by fibrous tissue which surrounds the head of the humerus, forming a new capsule and closing the hole in the old capsule. This fibrous tissue is partly due to degeneration of the muscles which stretch over the head of the humerus and is partly derived from such fragments of capsule, of fat, of cellular tissue, of fascia, and of aponeurosis as lie in contact with the dislocated head. In a few weeks it becomes more and more impossible to distinguish these various components, which, so to speak, fuse together. A thin layer of cartilage may form on the new joint surface of the scapula, but in the glenoid fossa the cartilage either altogether disappears or leaves only a few scattered "islands" behind. The new capsule has a glistening interior surface as if lined with synovial membrane, which apparently secretes a rather scanty synovial or pseudo-synovial fluid. The glenoid fossa

is filled with tissue, sometimes formed by adhesions of the outer part of the capsule and of the external rotator muscles and sometimes partly of these and partly of bone torn from the greater tuberosity of the humerus. The head of the humerus besides being altered in the manner already related is often greatly changed as a sequence of fractures of the greater tuberosity or of the anatomical or of the surgical neck. This change is usually increased by the formation of callus, of osteophytes, and of ossifications in the attached muscles. In one case it was described as resembling in shape the upper extremity of the femur. In one of my cases it was greatly increased in the transverse diameter.

TREATMENT.

The choice lies between, on the one hand, endeavouring to make the best of this new joint by exercises, massage, and electricity, and on the other attempting to effect reduction by means of (1) manipulation or extension; (2) open incision; and (3) excision. Subcutaneous division of soft parts may be regarded as superseded by open antiseptic operation. Some good results of the subcutaneous method were reported by Polaillon and Mollière. Division of the anatomical neck followed by an endeavour to place the upper end of the shaft into the glenoid has been recommended. I should be loth to try this mode in the case of the shoulder because I have seen it so utterly fail in the case of dislocation of the head of the radius at the elbow. After a mere division of a bone the fragments, even when carefully displaced, lie alongside each other and tend to unite ultimately. Passive movements are usually too painful in such cases to be used effectually.

The attempt at reduction without cutting.—This may reasonably be tried any time up to the end of the fourth month except in old people with atheromatous arteries. First of all Kocher's method should be applied (1) without anæsthesia and (2) with ether or with chloride of ethyl. As it is *not* involuntary muscular contraction which makes the difficulty the anæsthetic is given to prevent pain and need not always be pushed to the most profound depth. Remember what has already been written above about the danger of chloroform in this class of cases. Kocher's method having failed, extension and circumduction may be tried. The means of counter-extension should not press upon the folds of the axilla. To prevent this Skey invented his knob. In the absence of such an instrument some large firm pad should be placed in the axilla and the counter-extending force made to bear upon it. The extension should be made in four directions: (1) extension in the line of the axis of the humerus downwards; (2) counter extension upwards; (3) from the upper part of the humerus just below the insertion of the pectoralis major, outwards; and (4) counter-extension to force 3, from the side of the chest across the thorax. If a machine is used my fracture extension machine will do, *but a dynamometer must be employed*. The degree of force justifiable would depend on the age and development of the patient. I think 100 pounds is the outside which should be employed even for a strong man. Such a force can effect a good deal of stretching if employed continuously for several minutes. It should be possible to release it instantly either by pulling one end of a simple loop or by cutting a cord with a sharp knife, which should lie open and close at hand. Guérin reported a case in which the forearm was torn off. After the forcible extension and rotation a second trial of Kocher's method may be made. There should be no hurry. Many accidents have followed such attempts at reduction, even when reported as having been of gentle character.

Fracture of the surgical neck of the humerus is not very frequent. It occurred in four out of the 73 cases in which reduction was attempted in von Bruns's clinic. Of these four, three occurred in women (Finckh). In a case recorded by Kocher in which this accident occurred he reduced the upper extremity of the shaft into the glenoid. A false joint sometimes follows. The functional results may then be good. A false joint followed a case of Albert's in which the surgical neck broke and he pulled the head into the glenoid with two hooks. This was, of course, an open operation. The shaft of the humerus has been broken in employing Kocher's method Limited paralyses, e g. of the fingers, are sometimes caused but they are usually only temporary. However, main cords of the brachial plexus are said to have been torn. Flaubert reports a case.

The structure especially endangered is the axillary artery. Many cases have been collected by Flaubert, Malgaigne, Callender, Le Fort, Willard, Marchand, Körte, and Stimson. In Stimson's collection of 44 cases the axillary vein alone was ruptured in three (Froriep, Price, and Hailey), although he thinks the last one doubtful, and the artery and vein together in two (Platner and Baum). In most of the others the axillary artery or one of its branches was injured, but in some the source of the hæmorrhage remains uncertain. The upper was always the part of the artery injured. In a minority of the cases only a small opening was found and that on the anterior wall of the artery (see, e.g., Callender's case, op. cit). In more than half the cases the dislocation was recent (less than three weeks old). Sometimes it is certainly caused by the dislocation and not by the reduction. Often great force had been applied. As I have already written Callender and Holmes say the force used in their cases was moderate or even slight. Stimson says that "the accident is most to be apprehended when the elbow is raised in abduction to the height of the shoulder, or is carried, as in Callender's case, across the chest and face in a wide movement of circumduction; and for this reason, that in these movements the dislocated head of the bone is turned downward into the axilla and the vessels which lie upon its inner side are pressed down before it and put upon the stretch, while those branches which run almost directly outward, the subscapular and circumflex, and are fixed to the tissues amid which they branch, are directly and forcibly elongated."

The symptoms of rupture of the axillary artery vary. Sometimes, as in Callender and Holmes's cases, a large diffuse swelling appears quickly in the axilla and grows to an alarming size, discolouration also appearing, but no pulsation and little or no bruit, while even the radial pulse may be little affected. In other cases the ordinary signs of aneurysm, pulsation and bruit, are present. Some cases have been so chronic and the tumour so small that aneurysm has not been suspected and they have been incised. Rupture of the axillary artery is at best a serious accident, but the statistics of Stimson and the other authors mentioned, being mainly drawn from pre-antiseptic times, are unduly alarming. It is remarkable how many patients have recovered without any operation at all. But Stimson found the total fatality of the accident to amount to 70 per cent.

In a case of rupture of the axillary artery associated with dislocation of the shoulder I should be disposed (1) to place a temporary ligature on the subclavian; (2) to clear blood and clots out of the axilla, to tie any branch of the axillary found torn or the axillary itself if it was torn in two or nearly in two, but to leave it untied if there was merely a small oval hole in it (as occurred in 5 cases out of 32); this small hole I would close by suture if that operation proved easy; in any circumstances I should pack the axilla carefully with antiseptic or aseptic gauze. (3) If the patient's condition was not of the best, I should immediately inject neutral saline solution either subcutaneously or into one of the veins exposed by the operation. Owing to the everyday practice of clearing out glands, surgeons nowadays are much more at home in operating on the axilla than were the surgeons, great men as some of them were, who reported the cases collected by Stimson.

After the operation careful bandaging would be, of course, essential and should fix without compressing the whole arm and hand to the trunk. If the dislocation still required reduction, and especially if attempts at reduction had been made and failed, it would probably be best to defer trying to reduce it. But all would depend on the age and condition of the patient and on the age of the dislocation.

Other modes of using extension besides (1) manual force, (2) the old-fashioned pulleys and (3) machine extension are (4) continuous elastic extension and (5) the use of Stimson's perforated couch. Continuous elastic extension is mentioned by Ceppi as having been used by Legros, Th. Anger, and A. Després. The use of a dilatable indiarubber bag in the axilla, as employed successfully by Cock in a case of 25 days' standing, is related to this method. An air pad of rubber was placed in the axilla and the arm was firmly bandaged to the side. On the removal of the pad on the third day reduction had taken place. Stimson's couch is perforated to permit the arm to pass through. A weight of ten pounds is attached to the hand which, of course, hangs down beneath the couch. Its dragging gradually effects reduction. This is obviously a very simple plan, not alarming to the patient, and, I should think, not likely to be very painful.

OPERATIVE TREATMENT OF OLD UNREDUCED DISLOCATION OF THE SHOULDER.

Before considering this subject critically I will relate my own personal experience and also cast a glance over the literature of the subject so far as it is known to me.

CASE 1.—The patient was a female, aged 51 years, who was admitted to the West London Hospital on Jan. 10th, 1890. (The case was reported by Dr. F. J. McCann, house surgeon.) A year and a week before she fell and put her shoulder out. On the same evening a medical man told her that he had reduced it, but it was never kept in position. A month afterwards she came to the hospital and, after an unsuccessful attempt at reduction, was advised to come in; but she did not until the above-mentioned date when she came on account of the considerable inconvenience which she felt from impaired movement.

Operation was performed on Jan. 14th. A four-inch incision from the clavicle downwards was made separating the anterior fibres of the deltoid The head of the humerus being exposed, the two tuberosities of the humerus were separated, each from the head of the bone, with a chisel and mallet. The joint cavity being opened, the head of the humerus, which was roughened and irregular, was found to fit into a new socket below the coracoid. Extension and counter-extension being applied, the head of the humerus was forced out of its abnormal position, with the result that, although it could not be retained in a position exactly symmetrical with the humeral head of the other shoulder, it was very much improved. (Refer to the account given above of the changes in the glenoid in old-standing subcoracoid dislocations.) Silver-wire sutures were used, a drain being put in the upper angle of the wound. Iodoform gauze and wood-wool pad dressings. Especial care was taken to fix the arm to the side. The dressing was repeated on the same night on account of the oozing of blood. The wound was dressed again on the following day and the drainage-tube was removed; it was also dressed on the fifth and the eleventh days, the sutures being then removed. Healing per primam followed. The temperature never reached 99° F. after the third day. Passive movements under gas were begun at the end of the second week. The patient was discharged on the twenty-second day.

With the exception of Lister's case of double dislocation in an epileptic there is no case of reduction of a dislocation of the shoulder-joint by open operation recorded as having occurred anterior to this either in the British Isles or in America. I am going by Reerink's collection of records. This month (December, 1903), nearly 14 years after the operation, Dr. Frank Dendle of Isleworth kindly went to the patient's address to report on her after-history. He learnt from her daughter that she had died meanwhile but had found her arm equal to all its duties for eight years after the operation and had not complained of it.

CASE 2.—The patient, a man, aged 36 years, was admitted to hospital on March 14th, 1899. The case was reported by Dr. G K. Briggs, house surgeon. Six weeks before, while whitewashing a wall, he slipped off a box and dislocated his shoulder. A medical man tried unsuccessfully to reduce it and sent him to hospital. There it was said to have been reduced under an anæsthetic and the arm was confined to the side for 11 days. It was then examined by a medical man who noticed nothing wrong but the arm continued to be helpless. The patient had it examined by the x rays and said he was told that the head of the bone was "two inches lower than it ought to be." The head of the bone could now be seen prominent beneath the coracoid process.

Attempts to reduce the dislocation having failed on March 17th an operation was performed. After an incision downwards from the clavicle, the deltoid and pectoralis major being retracted and the fascia divided, the coracoid process was chiselled through and the end was turned down with the short head of the biceps. The head of the humerus was now exposed freely by a perpendicular incision, with another cut nearly at right angles to it and running outwards from its upper end. The long head of the biceps was very tense and interfered with reduction. It was, therefore, divided very obliquely. A powerful pair of rectangular forceps was slipped round the neck of the humerus and using them as a hook, not as forceps, while at the same time extension and counter-extension were made on the limb, the dislocation was completely reduced. The wound was dressed for the first time on the thirteenth day. Healing was complete on the twentieth day, the movements in the joint being fairly free, and the patient left the hospital. The highest temperature throughout the case was 98·8° F.

I come now to cases treated by excision of the head of the humerus.

CASE 3.—This occurred about 20 years ago and I have not been able to find any notes of it. An old man was admitted into the "accident" ward of the West London Hospital. There was obviously displacement of the upper end of the humerus combined with fracture. No doubt there was considerable swelling and of course there were no x rays in those days. I cut down on the joint and found a fracture chiefly of the anatomical neck of the humerus. The cartilaginous surface of the head of the bone, instead of being in contact with the glenoid fossa, looked outwards and downwards and was partly in contact with the upper end of the shaft of the bone and partly with the deep surface of the deltoid. I removed the head of the humerus and after trimming the upper end of the shaft placed it in the glenoid cavity. I am sorry to say that there was some suppuration but with free posterior drainage this quickly came to an end, the wound healed, and the patient went out. I am unable to give the ultimate results of this operation.

CASE 4.—The patient was a man, aged 50 years. Seven weeks before operation he slipped while wrestling, his opponent at the same time catching his right arm. At first, owing to the swelling, a diagnosis was not made. A fortnight afterwards several attempts at reduction were made under anæsthesia and unsuccessfully. There was a subclavicular dislocation of the right humerus. The head of the humerus was felt prominent below the clavicle and the arm projected from the side in a strongly adducted position (at an angle of about 45°). Flattening of the deltoid was not very evident "owing to the amount of the periarticular swelling and thickening present." (Much of the greater tuberosity was afterwards found in, and adherent to, the glenoid.)

Operation was performed on Jan. 20th, 1903 An incision was made between the pectoralis major and the anterior border of the deltoid The coracoid process was divided and turned down with its attached muscles. The fibres of the deltoid were now cut across for several inches about an inch from their acromio-clavicular origin so as to expose thoroughly the glenoid fossa. Filling this and adherent to it were fragments of the greater tuberosity and the insertion of its muscles. First the glenoid was cleared out and then the head of the humerus was freed from strong adhesions which surrounded it. Attempts of various kinds were now made to reduce the dislocation—extension and counter-extension, assisted by strong hooks, circumduction, and manipulation—but unsuccessfully. One hook was used to pull the glenoid up and another to pull the neck of the humerus out. The head of the humerus would nearly rise on to the edge of the glenoid but not quite. Finally, the greater part of the head of the humerus was cut off at the anatomical neck. The arm now came into fair position. Gauze packing and a continuous skin suture were used. A week afterwards the wound was reopened completely, a small projecting portion of the humerus was rounded off, and the upper end of the bone was forced into the near proximity of the glenoid fossa by pulling it outwards with a strong hook. A piece of 'gold plate" was moulded over the end of the humerus (and a little way down the surgical neck to prevent it from becoming adherent to the neighbouring soft parts). The coracoid process was fixed in its place again with a silver wire, the deltoid was restored with a buried suture, and gauze was inserted, especially in the hole left below the clavicle. Thick dressings were placed in the axilla and elsewhere and the arm was bound to the side. It was one month before the wound completely healed over the gold plate, although there was no rise of temperature (the highest point reached was 99·2° F.) and there was no discharge except from the granulations which formed where the gauze had been packed in. The gauze packing was occasionally removed, of course, except during the first week; the outer dressings were changed daily.

On the fortieth day of the insertion of the gold plate the old incision was reopened, the gold was removed, and the coracoid process and divided muscles were repaired with buried sutures. A fortnight afterwards passive movements were commenced, the first time under gas. One month after the removal of the gold plate the patient went out.

From beginning to end of this case the temperature rose only once to 100° and on one other occasion to 99°.

CASE 5.—The patient was a male. Four months before operation he was knocked off a bicycle and treated by a bone-setter who professed to have reduced the dislocation. In August, 1902, he attended at the hospital and an unsuccessful attempt at reduction was made under anæsthesia. I was then away on my autumn holiday. The patient was taken in after my return and had then obviously an old unreduced subcoracoid dislocation. On Oct. 3rd, 1902, having failed to effect reduction myself after using the pulleys, I proceeded to operation. The head of the humerus was found packed in by exceedingly dense tough adhesions closely attached both to it and to the surrounding structures. The attempt at reduction was conducted on the same lines as in the case last described, but unsuccessfully. As this patient suffered from no pain and as excision cannot be depended on to give a very wide range of movement I did not excise the head of the humerus but closed the wound except where it gave issue to a gauze drain. On the day of operation the temperature rose to 100° F. On the next day it dropped to normal and remained there. He went home on Nov. 7th in the same condition as when he was admitted. Cases 4 and 5 were reported by Mr. Kenneth Breton, house surgeon.

Many excellent analyses of cases from various clinics such as Kocher's, Kraske's, and von Bruns's, many interesting individual cases such as those of Annandale, Savory (quoted by Marsh), Sheild, Lister, Albert, Burckhardt, and von Volkmann, and valuable anatomical observations such as those of Flower, von Thieme, and Jössel, have enriched the literature of this subject. References will be given at the end. Of the first class of papers I have found especially valuable those of Ceppi (on Kocher's method), of Reerink (Kraske's clinic), and Knapp (von Bruns's clinic). The works of Astley Cooper, Malgaigne, Hamilton, and Flower are still valuable storehouses of facts, although they wrote before the position was altered by the advent of antiseptic surgery, and a writing which has the stamp of genius is always of interest. All the great surgeons of pre-Listerian times justly condemned open operations for unreduced dislocation of the shoulder. The antiseptic era came; and in 1874 Thiersch excised the head of the humerus in a six years old case. In the same year Albert of Vienna tried to effect reduction by open operation, but the surgical head of the humerus fractured and the result was non-union and a false joint. In 1875 Annandale resected the humeral head in a subclavicular case. The atheromatous circumflex artery was torn. Ligature of the axillary artery was followed by death in three days.

In this country Sheild appears to have been the first to record a case of successful resection in 1888. Adams referred to another in the debate on Sheild's paper, and in the same year Lister described a remarkable case of successful operative reduction of dislocation of *both* shoulders and also a somewhat similar case in which he removed the articular surface of each humerus, cutting obliquely through the anatomical neck. In 1889 Mayo Robson reported a case of operation on a patient with the rare supracoracoid dislocation, which he incised but found irremediable by operation. My own first case of operative reduction, reported above, occurred in 1890 (Jan. 19th). In America Parmenter of Buffalo reported a successful case of operative reduction in 1891. In the meantime von Langenbeck (three cases), Ried (four cases), Schönborn (three cases), Kocher (eight cases), Nicolaysen (two cases), as well as Louis Thomas, Socin, Israel, Burckhardt, Book, Maas, Volkmann, and Bardenhauer (one case each), had published reports on the continent. So that a few years later (in 1896) Reerink was able to collect reports of 46 patients thus operated on, and, of course, in this period there must have been others unpublished (e.g., two of my own). In a majority of the cases excision was performed; in some nothing was done except to close the wound after inspection.

In spite of the eminence and great general operative and antiseptic experience of the above named surgeons, Reerink says that healing by first intention occurred only eight times after arthrotomy and only four times after resection. Severe suppuration is expressly stated to have occurred after nine excisions and five arthrotomies. In a number of cases it is not clear exactly what course the wound took and in the great majority the ultimate and distant results, as regards function, are not given and appear not to have been observed. The immediate results seem to have generally satisfied the operators. But of the 46 patients seven died (17·4 per cent.); of the resection cases three died from sepsis and one from secondary hæmorrhage; of the arthrotomies one perished from long-continued suppuration, one from purulent bronchitis, and one (on the twenty-sixth day) from miliary tuberculosis. The addition of my own cases to the above series would reduce the mortality to about 13 7 per cent. It must be remembered that some of the above cases date from the "seventies" and "eighties" and that of late there have been great improvements made in the protection of this class of case from sepsis. Nevertheless, they demand the greatest care and some special experience of joint surgery and that in a greater degree than do operations on other large joints, such as the elbow and the knee.

Why is it difficult to preserve perfect asepsis in this class of operation? There are a number of conditions, most of them common in other operations and not individually formidable but collectively causing considerable danger: (1) The class of operations under consideration are prolonged; (2) the wound is large and deep, the patient being often fat and muscular; (3) retraction is apt to be rough and prolonged; (4) the displaced head vacates a large space, the walls of which do not collapse and obliterate it; (5) the drainage of this space is contrary to gravity; (6) more than one assistant is employed (and needed); (7) talking arises when difficulties present themselves, hence the risk of infection by saliva; (8) the operator and assistants may be tempted to handle parts of the limb or trunk not aseptic; (9) the anæsthetist and the patient's hair and mouth are near the field of operation; and (10) the patient, generally a middle-aged male and often the reverse of abstemious, is not always "a good subject." But measures can be taken to guard against these risks and these will be described presently.

THE PRACTICAL MANAGEMENT OF OPEN OPERATION FOR UNREDUCED DISLOCATION OF THE SHOULDER-JOINT.

Unless the patient is obviously young and healthy it is not enough to have his urine examined but two or three drachms of blood should be withdrawn from some small vein and subjected to the blood-freezing test. If this test gives a satisfactory result, well and good, but if not, either no operation at all should be done or, if an operation seems imperatively necessary in consequence of painful pressure on the axillary nerves or vessels, the operation must be of the simplest kind, executed with absolute directness—i.e., it should be a straightforward, uncompromising resection of the head of the humerus, performed through an ample incision. In other cases the decision between resection and attempted reduction may be deferred until the glenoid cavity and the humeral head have been exposed.

Whatever the operation may be, all the general arrangements to secure asepsis should be made with particular care, and, further: 1. At least two good, trustworthy, and strong assistants should be secured. 2. Both they and the anæsthetist should be requested to avoid talking or, if they should have anything important to say, to turn the head away from the field of operation while saying it. 3. The operator should direct them as much as possible by signs during the operation, after giving them a clear outline of his plan beforehand. 4. In this, as in all long operations, the assistants should rinse their hands in some disinfecting lotion, such as warm 1 in 2000 sublimate solution at frequent intervals. The surgeon does this as a matter of course. 5. The assistants, if not the surgeon, should wear gloves either of rubber or of white cotton, preferably the former, of course carefully sterilised. 6 All handling of either the wound or the ligatures should be reduced to a minimum; in particular the fingers should not be used as retractors. 7. The patient's hair, neck, jaws, and chin should be asepticised, so also should the outside of the ether bag and the anæsthetist's hands. 8. The incision should be arranged to give free access without violent retraction. (The incision which I have found the best for shoulder-joint cases, and I learn that it has been recommended for excisions independently by Tiling and Paulet, is a long skin incision at the anterior margin of the deltoid just external to the cephalic vein, then separation of the most anterior fibres of the deltoid just beneath this incision, and lastly, a cut two or three inches long through the deltoid at least half an inch below the clavicle and acromion. In this way both the glenoid and the humeral head, both the old and the new scapular articular surfaces, can be reached; and, at the same time, the nerve-supply of the deltoid is not injured.) 9. Whenever the act of operating is suspended temporarily—e.g., to attempt reduction by manipulation or

by extension—the field of operation should be covered by gauze. 10. Care should be taken beforehand that every instrument which can possibly be wanted is ready in its proper dish, especially the strong, wide-open, blunt hooks and the dynamometer. There should be a hook at each end of each instrument so that there may be something to pull at as well as something to pass round the neck of the humerus and round the neck of the scapula. If these hooks are curved much they are difficult to get into position; indeed, I found it impossible to place them rightly for this reason in one of the cases in which I tried unsuccessfully to effect reduction. In my second successful case I used as a hook a powerful pair of forceps. Possibly a very strong lever, somewhat spoon-shaped at one end and one and a half feet long, would prove useful.

One preparation for the operation should be placing the skiagram in a good light and in a position convenient for the operator to inspect it without going far from the operating table. If there is a bystander who will kindly take charge of it so much the better. The skin and fat should be incised first and the anterior edge of the deltoid should then be made out so as to go through the muscle posterior to it. The transverse cut through the deltoid should be about an inch from the clavicle so as to leave something to attach the buried sutures to. The coracoid process should be divided and turned down with the attached muscles and after division of any covering fat and fascia it will be possible to examine the new capsule and its relations and also to feel what occupies the glenoid cavity. The next step depends on what has happened to the greater tuberosity. If it and the muscles inserted into it are intact the tuberosity should be separated with a chisel. (This and the coracoid are to be sutured on again after the reduction.) But if either the tuberosity or the muscles have been torn off, the structures covering or filling the glenoid must be reflected outwards so as to empty that cavity. It may be found that they are very loosely attached to the bottom of the glenoid though firmly fixed to its edge. The long head of the biceps should be spared. The glenoid having been cleared and made as smooth as possible the next step is to free the humeral head. In a comparatively recent case this may be easy—indeed, circumduction may suffice to do it. But in older cases it is a measure requiring caution for two reasons: (1) axillary vessels or nerves may be adherent to the humerus; or (2) if in order to avoid all risks to those structures the operator cuts or rasps too close to the bone he may provoke necrosis. However, the head and neck of the humerus *must* be freed and the axillary vessels and nerves *must* be taken care of and I do not think there is much risk of necrosis if reasonable care be taken of the periosteum and if stringent antiseptic precautions be adopted.

The new capsule or the mass of adhesions which surround the head of the humerus should be freely incised longitudinally in front and also transversely right up to the anterior edge of the glenoid. A new joint may be thereby discovered or the head of the bone may be found everywhere adherent. The head of the bone may also be seriously altered in shape and with osteophytes adherent. It may require a little trimming. There can be no hope of a painless joint if any osteophytes are left projecting on the joint surfaces. The gouge should be used and *a depression substituted for every projection*. Osteophytes round the head or anatomical neck can be trimmed off with a chisel or cutting forceps.

Next comes the attempt at reduction. The surgeon and his assistants having protected their hands with aseptic towels the trunk should be fixed and the steps of Kocher's method carefully and patiently gone through, the elbow being carried well backwards and inwards, as it were, towards the spine. If this fails the hooks should now be put in place—one round the neck of the humerus, the other round the neck of the scapula. The assistants should pull steadily and strongly on these while the surgeon repeats the steps of Kocher's method. If this also fails the hook round the neck of the humerus should be left *in situ* and my fracture extension machine used in conjunction with it, not forgetting the dynamometer. If any muscle, tendon, or fascia seems to be obstructive—e.g., the long head of the biceps—it may be divided, preferably in an oblique or in a zigzag manner, so as to facilitate restoration by suture after the reduction. During strong extension the pulse and breathing should be vigilantly watched.

If all these efforts are unsuccessful excision should be done. It will generally suffice to saw through the anatomical neck. The stump left by removing the head must be carefully trimmed with saw, chisel, or bone forceps. It should then be placed in the glenoid and now, if desired, gold plate can be wrapped round it to prevent it from adhering to the glenoid until, in about five weeks, both are made comparatively smooth by natural processes. The gold plate should be pressed well down around as well as on the top of the stump.

The following directions apply to those cases in which the dislocation has been reduced and also to those in which it has been found necessary to excise the humeral head. If the greater tuberosity has been chipped off and not removed it should be wired to the humerus and will materially help to keep that bone in place. The wound should be carefully dried and every cavity cleared of clots and, still more carefully, of loose bony fragments. As few ligatures as possible should be used. The cavity from which the head of the bone has been shifted should be gently packed with a broad sheet of iodoform gauze, not with a mere narrow strip. An ample opening should be left in the skin wound to permit this gauze to be changed. A small rubber tube should be carried to the bottom of the wound alongside this gauze packing. It should have no lateral perforations; its use is to permit lotion to be dropped or gently syringed down it to loosen the gauze at the dressing. A tube is no sufficient substitute for the gauze packing. The displaced muscles should be replaced and united with a few interrupted catgut sutures, of course leaving room for the gauze packing to pass through.

If no gold leaf[1] is used the gauze packing may be diminished in size at each dressing until it is dispensed with altogether in about a fortnight. If gold leaf is left it will be safer to keep a strip of gauze in till the removal of the gold and for a few days longer. Should the wound then not quickly heal the cause will be a catgut knot or the silver wire re-uniting the coracoid. It may be found convenient to defer wiring the coracoid until the gold plate is taken out; packing and repacking the abnormal joint cavity beneath it will thus be made easier.

As soon as ever the wound is healed, if no gold plate is used, or a fortnight after the plate is removed, is a suitable time to commence passive movements. Abduction should be avoided for a long time (months), and however much the elbow is carried backwards or forwards, up or down, or rotated, it should be kept as near as possible to the mesial plane of the body. In another week or fortnight the patient should commence to exercise himself with a Whiteley's exerciser or with a stout cord passed over a single pulley in the ceiling and with one end of the cord in each hand.

All iodoform gauze used should be kept in 1 in 20 carbolic lotion, but that lotion should be carefully washed out with plenty of 1 in 2000 warm sublimate solution just before the gauze is used.

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[1] This should be gold "plate," of gauge 0·75. It should be carefully weighed before insertion and after removal and may be had of Messrs. Wellby, Garrick-street, Covent-garden, who will, if required, re-purchase it after use.