INDUSTRIAL ASPECT OF FRACTURES OF THE OS CALCIS *

BY

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(WITH SPECIAL PLATE)

From an industrial point of view the os calcis presents a problem as important as it is complex. Excluding those in children, two out of every hundred fractures in the body involve the os calcis and occur in wage-earning men at a time when they have dependent families and can least afford the loss which may follow such an injury.

TABLE I

Age	Percentage of Total (63)	Age	Percentage of Total (63)
10-15	2	45-55	25
15-25	1	55-65	17
25-35	15	65-75	7
35-45	33		

Note nearly 60 % between the ages of 35 and 55 years.

My own experience indicates that the loss as regards money and physical condition is very considerable, and I wondered what others had found. Investigation of the literature confirmed my gloomy view.

Previous Literature

Golebiewski (1897) stated that he had not seen a perfect recovery in any of fifty-nine cases. Cotton (1908) reported permanent disability in more than 50 per cent. of examined cases. In 1923 Magnuson reported that in his capacity as medical director of the Illinois Industrial Commission he had seen practically no case of fracture of the os calcis which did not result in from 30 to 75 per cent. disability of the foot. In 1923 also Satta stated that the disability from fractures of the os calcis might amount to as much as 80 per cent. He added that in Switzerland the insurance companies settle these cases on a basis of one-third total disability for a period of from two to four years.

Malpas (1925) investigated the period of disability in a series of fractures at the David Lewis Northern Hospital. In most of these cases no definite attempt at reduction of the fractures was made. Malpas found that at that time the average period of disability was eleven months, and from a comparatively small number he concluded that irregularity of the subastragaloid joint was the deciding factor. Harding (1926) estimated the average duration of disability as five months. Otto J. Herman (1930) reported good result in 77 per cent. and a poor result in 22 per cent. Funston and Hall estimated the average disability period as six months.

In 1931 Bartley wrote: "All surgeons of much industrial experience and all industrial compensation boards are unanimous in giving to this injury a very bad prognosis." His figures tend to show difference between the disability period of comminuted fractures which enter the subastragaloid joint and those which do not. He performs a subcutaneous tenotomy of the tendo Achillis and almost immediate subastragaloid fixation. He cites as a specially good result the case of a man who went back to his occupation in five months' time. He does not specify his occupation, though since he fell from a roof it is

probable that he was either a builder's labourer or a slater, or possibly a private detective. It appears that the man could support the weight of his body upon the ball of the foot and also on the heel. But rather naïvely the surgeon remarks: "There was no defect in any of the motions of the foot or ankle except the loss of *eversion* and *inversion*."

In 1932 Rudolph S. Reich stated that fractures of the calcaneus still resulted in permanent disability in a discouragingly large proportion of cases. He reported ten recent fractures, the treatment of which involved a subcutaneous elongation of the tendo Achillis, and six weeks later a subastragaloid fixation; the most fortunate of these patients was back at work in six and a half months. The average for most of the others was eight and a half months: one was not back at work after two years, and was then still complaining of pain. One was ten months before he went back. After two years three of them were on light work only. The curious point is that in nine old fracture cases there was a disability period following operation of about the same duration as the recent fracture cases—namely, six and a half months to ten months or a year. Nevertheless, the case of a man he had operated on eleven months previously was mentioned as being too recent to report. Wilson (1933) recorded the results of fifteen recent fractures, not all crush fractures into the joint, but did not indicate the disability period nor the amount of permanent incapacity.

Forrester (1934), referring to the cost of this type of fracture, reported that before his newer type of treatment the average disability was from nine to sixteen months. Permanent disability was about 80 per cent. He claimed to have reduced the period of disability to four and a half months. He elongates the tendo Achillis and keeps the patients off their feet for some time. It is difficult to assess his results, because all his unselected cases have the same period of disability—four months—and their functional end-result is 100 per cent. It is rather difficult to determine from his x-ray illustrations how bad the fractures were. Böhler does not denote his exact periods, but is reported to have said that about 80 per cent. of his patients got back to heavy work, though this may be delayed for as long as two years.

At a North American meeting one speaker was very illuminative; he remarked that he had treated fractures of the os calcis in every way that had been devised, and that he knew of no injury which produced as much disability. He usually had a patient under his care anywhere from nine months to a lifetime, and they often never went back to work.

Estimations of Cost

All authorities agree that the cost is high. The total economic loss is made up of four items: (1) cost to the insurance companies; (2) cost to the men; (3) cost to the hospitals; and (4) physical deterioration.

I tried to obtain estimates from insurance companies. On approaching several large companies I was invariably referred to the Accident Offices Association in London, where I learned, as I had been advised also by the insurance companies, that they were not actually interested in fractures individually, but in types of work. For instance, they insure a firm, not against fractures of the os calcis, but against any injury. For their own sakes their statistics are concerned in the accident rate of a particular occupation rather than in the period of disability of any specific injury. The same is not true of a firm which carries its own insurance, but even they have little exact knowledge of the cost to them of a fracture of the os calcis.

* The opening paper of the annual meeting of the British Orthopaedic Association at Manchester.

Owing to a series of changes in hospital appointments, I have few personal figures which I am at liberty to use, but I have investigated the patients who have attended my present hospital during the last five years. The following is a table showing their occupations, the average duration of incapacity, the percentage of permanent incapacity, and the proportion of the total who were rendered permanently incapacitated for work.

TABLE II

Occupation	No.	Average Duration of Incapacity	Percentage of Permanent Incapacity
Labourers	24	1½ years (in 25%)	50
Scalers... ..	2	6 months	15
Painters	2	6 months	10
Window cleaners	4	1 year (in 50%)	30
Bricklayers	2	2 years	40
Coal heavers	2	—	80
Stevedores	2	—	80
Housewives	4	5 months	10

Note the large proportion of labourers and how long their average duration of incapacity was; many of them remain permanently disabled. The bulk of the permanently disabled fall into this category.

Bad as these figures are, they are not so bad as those in the next table, taken from patients referred to me for a medical report for legal purposes. The disability period had to be estimated as a minimum, and it will be seen how heavy this minimum is, the average being well over one and a half years.

TABLE III

Occupation	Number	Average Minimum Period of Disability
Builder	3	13 months
Boilermaker	1	19 "
Chauffeur	1	19 "
Labourer	5	13 "
Marine fireman	1	9 "
Haulage contractor	1	21 "
Carter	2	9 "
Painter	2	19 "
Joiner	2	19 "
Shipwright	1	24 "
Unknown	2	21 "

I estimate the average cost of an os calcis fracture as follows:

1. Cost to the insurance companies	£150	} About £250.
2. Cost to the men...	75	
3. Cost to the hospital	20	
4. Physical deterioration cannot be estimated.		

Factors in the Protracted Disability

Let us consider what gives rise to this long, costly disability. We are taking for granted that fractures such as that shown in Fig. 1 (Special Plate), and also crack fractures without displacement or involvement of the subastragaloid joint, recover comparatively quickly, with little or no permanent defect. It is with the type of fracture represented in Fig. 2 that we are concerned. There are many factors involved, medical and non-medical; they are interwoven to produce a complicated problem.

One man who had sustained a typical fracture of both os calces seems to me the personification of the problem.

After reduction and splinting under an anaesthetic, followed later by manipulations, he complained of the usual symptoms. A surgeon acting for an insurance company arthrodosed his left subastragaloid joint (Fig. 3). Some time later I arthrodosed his right subastragaloid and mid-tarsal joints (Fig. 4).

His complaints were little if at all lessened. As far as external examination goes his feet look good. The foot in which the three joints were arthrodosed is better than the foot in which only the subastragaloid fixation was undertaken. He walks like a "cat on hot bricks," but a cinematograph analysis shows that all phases of walking are performed normally. Would this man have been any different if his feet had been arthrodosed at first?

This patient compares very unfavourably with another who sustained a similar injury to both feet, and whose clinical and cinematograph analysis suggested very little disability five months after injury. He was treated in a way I will describe later. Fig. 5 shows the x-ray result.

This first patient differs markedly also from a man who sustains a fracture of the os calcis when not at work. I remember an engineer who fell from a roof when "larking" in the dinner-hour. Both his os calces were crushed, and in three months he was back at full work. The same is partly true when a man is unaware of the fracture. I examined a man once who had a fractured femur and os calcis, though the latter had never been recognized. He was off duty for five months and returned to work, only complaining slightly of his heel.

The medical and non-medical factors referred to can roughly be divided into two groups:

1. Medical: (a) attitude of the surgeon; (b) subastragaloid arthritis; and (c) the type of treatment.

2. Non-medical: (a) unemployment; (b) influence of solicitors and doctors; (c) the type of man; (d) the type of his employment; and (e) the Workmen's Compensation Act. So far as one can disentangle the various medical factors, it is certain that a firm and carefully optimistic attitude on the part of the surgeon has important psychological effects.

Subastragaloid Arthritis

As regards my own observations and also as a result of investigating these hospital patients I have come to the conclusion that subastragaloid arthritis is not the deciding factor in the length of a man's unfitness or the severity of his permanent disability. The following radiographic reproductions and notes illustrate what I mean.

Fig. 6.—This x-ray picture was obtained three months after a comminuted fracture of the os calcis with displacement and involvement of the subastragaloid joint. The patient returned to work about four months after the injury. The treatment is described later.

Fig. 7.—In this case the patient was only off duty for six months. The x-ray illustration shows arthritis and deformity, yet he only had a short disability, and no symptoms at all five years afterwards. His cinematograph record shows no disability.

Figs. 8 and 9.—One side was noticed and treated; the other side was not noticed at the time, and was not treated. The patient has no symptoms at all in the untreated side. His x-ray films show that there is arthritis and deformity of an almost equal degree in both feet. He complains only of the one that was treated, and his cinematograph record supports this.

A lady sustained a very comminuted crush fracture of the os calcis with great displacement; she was treated in the way

described later. Her x-ray films six months later showed very considerable osteosclerosis. In the neighbourhood of the subastragaloid joint some deformity of the bone persisted. She was off work only for a short period. Her cinematograph analysis appeared normal. (Owing to lack of space it is impossible to reproduce the x-ray films.)

A man sustained a crush fracture of the os calcis which resulted in severe deformity and subastragaloid arthritis, but he had no disability. (Lack of space prevents reproduction of the x-ray films.)

Another man sustained a similar injury; x-ray films nine months after injury did not show any arthritis and very little deformity. He has a severe disability. (Lack of space again precludes illustration.)

Moreover, a subastragaloid arthrodesis does not necessarily stop their pain nor terminate their disability. The first patient recorded in this article affords one example, and another follows herewith.

Following a crush fracture a man had marked arthritis, shown in an x-ray film made on March 1, 1932. Some time later a subastragaloid arthrodesis was performed, and the result is indicated in an x-ray photograph taken on September 7, 1935 (Fig. 10), which also shows the amount of arthritis which has since occurred in the mid-tarsal joint. There was no improvement in his working capacity.

Treatment

I describe later my own preference. Over a number of years my observations have not led me to believe that there is much difference between the results of various other types of treatment.

Non-medical Factors

Unfortunately non-medical factors are very important, the type of man and of his employment being paramount. It is shown in Table II that a very large percentage were labourers, and that they had long periods of disability. Examples are given above of men with arthritis but no disability, and vice versa. I have come to the conclusion that from an economic point of view the type of person and his occupation matter more than the nature of the deformity or the presence of subastragaloid arthritis; a bad subject and heavy work forecasts a slow recovery, irrespective of arthritis; a good subject and good work indicates a quick recovery, even with deformity and arthritis.

Other non-medical difficulties are very great. A most difficult point to determine is whether a man is malingering. I think that these patients are rare. There is little to be gained to-day by malingering. Moreover, there is consistency in complaints from widely separated men and from men who do not know the nature of their injury. I have examined injured workmen for many years, and have found very little difference in the nature or extent of their complaints.

The typical complaints are as follows: (1) pain in the back of the heel; (2) pain on the outer side of the ankle-joint; (3) a feeling described as "toothache" in the pad of the heel; (4) a heavy, burning, bursting feeling in the main part of the sole of the foot; and (5) loss of spring—flattening of the heel and shortening of the leg. If a man has some disability he knows that he cannot return to work in fair competition with his fellows. Often too much is asked of him by the insurance company advised by a surgeon, and in response the man gives back the minimum. Sides are immediately formed. If we could avoid the formation of those sides and obtain close co-operation between the parties interested in getting the man back to work, I believe that we should enormously

reduce the cost to everybody. The best results occur with men employed by firms who carry their own insurance, and who work in close liaison with the surgeon.

How far can we influence the non-medical disability factor? In two ways—by our attitude and by our treatment. A sympathetic but firm and hopeful attitude must be maintained and patients must observe others around them recovering. It is bad for a fresh "os calcis" case to meet an "old chronic" one. The men must feel that they will completely recover and return to work able to compete fairly with their fellows.

Treatment

I believe that a long period of complete absence of weight-bearing is essential. By absence of weight-bearing I do not mean walking in a plaster, because I do not believe that a man walking in a plaster fails to take his weight ultimately through his heel.

I see no point in elongating the tendo Achillis under an anaesthetic. More elongation can be obtained by bending the knee than by dividing the tendon. The following is the treatment which I advocate; I have found it hopeful.

With an anaesthetic the fractured bone is moulded with the hands or with mechanical pressure, and the heel is pulled down as far as possible, the knee being well flexed. Plaster-of-Paris is applied, the heel being inverted, the foot plantar-flexed, and the knee bent almost to a right-angle. The knee is included in the plaster. Weight-bearing is not allowed for two and a half months, but the men are encouraged to use their intrinsic muscles. This treatment is continued when the plaster is removed and before weight-bearing begins. Patients are allowed to get about with a crutch if only one os calcis is fractured, but if both are crushed they are unfortunately "laid by the heels."

The average period of disability of six patients so treated is four months. It is quite possible that they were all very good subjects, but cinematograph films show very encouraging results. Four were stokers and labourers.

Employers and insurers must co-operate with the surgeon. As soon as possible work should be provided on a non-competitive basis within the man's ability. In other words, rehabilitation schemes should be instituted. Whereas "centres" will be unpopular and unworkable, large employers of labour by pooling their available work could operate schemes giving injured men within their group suitable work as a therapeutic factor. Work should not be used as a weapon against a man in minimizing his "compensation."

Thus would be avoided the long dead period between the times when the surgeon makes the man as fit as he can and when the man undertakes work having received some sort of settlement of what he feels is a just claim.

I also suggest that no doctor or surgeon other than those treating him should be in contact with the patient; and panel doctors should be legally excused from signing the "out-of-work" certificate. They have no desire to do so, but are unable to refuse because the patient will leave them for another doctor. It would be simple to tell the patient that they were not allowed to sign it.

I further recommend that patients who have been off work for more than nine months should have their disability estimated by three surgeons: one on their own behalf, one on behalf of the employers, and one to hold the balance. The decision of this tribunal should be accepted by both sides without any further discussion, and should be presented to the appropriate legal authority.

It is obvious that further investigation of treatment is necessary. I suggest that surgeons should be invited to join groups, each group setting itself to undertake a particular form of treatment, the lines of which should be rigidly specified. Members of each group would come from different parts of the country. For three years each group would continue on its own lines, change of treatment occurring only if its particular line proved hopeless, and only after consultation with the other groups. At the end of three years the respective results should be analysed and discussed.

THREE SEPARATE CAUSES OF ANTE-PARTUM HAEMORRHAGE OCCURRING SIMULTANEOUSLY*

BY

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(WITH SPECIAL PLATE)

This case is of interest as showing three different causes of ante-partum haemorrhage occurring together.

The patient was aged 40; she was a nine-para, the previous confinements and puerperia having been normal. There was no history of pregnancy toxæmia. She was admitted as an emergency case to the Birmingham Maternity Hospital on April 29, 1936, at the twenty-eighth week of her ninth pregnancy, during which she had been much troubled by vomiting from the end of the third month onwards, as a result of which she had lost a good deal of weight. During the previous four weeks she had noticed gradually increasing swelling of the feet and legs, but there had been no headache or visual disturbance. She had had several slight irregular losses per vaginam, the first of which had occurred at about the sixteenth week. Four hours before admission she had had a very severe painless haemorrhage, the amount being described by the nurse in attendance as half a bucketful.

On admission she was extremely pale and collapsed. The pulse was very poor in volume, the rate being 142 per minute; there was marked oedema of the whole of the body below the level of the umbilicus. The blood pressure was 118/40. The uterus was the size of one of thirty-two weeks—that is to say, a month larger than that estimated from the menstrual dates. It was tense but not tender; the foetal parts could not be felt, nor the foetal heart heard. The urine contained a dense cloud of albumin and large numbers of hyaline and granular casts. The loss on admission was only slight.

She was given one pint of 10 per cent. glucose saline solution, and her condition improved sufficiently to allow of vaginal examination being made under gas and oxygen anaesthesia. The cervix was found to be three fingers dilated; through it a soft and fleshy mass was protruding. Fragments of this were removed, and had the naked-eye appearance of hydatidiform mole. Further violent bleeding occurred, and the cervix and vagina were packed. She was then given a transfusion of one pint of citrated blood, which produced a definite improvement. I thought, however, that her condition was not sufficiently good to stand the further haemorrhage which must inevitably take place during the expulsion of the mole, and decided to treat her as a case of severe concealed accidental haemorrhage—namely, by abdominal hysterectomy without opening the uterus. Her age and parity afforded additional justifications for this line of treatment.

Laparotomy, under gas and oxygen anaesthesia, showed that the uterus was very pale and tense and that both ovaries were enlarged and cystic. There was no free blood in the

peritoneal cavity. Total hysterectomy was performed with practically no loss of blood; one pint of normal saline solution was left in the peritoneal cavity. Recovery from the operation was slow owing to her extreme degree of anaemia, the red cell count three days after the operation being only 1,700,000. She was given a second transfusion of half a pint of citrated blood on the fourth day, and from this time improved steadily, leaving hospital three weeks after admission.

I did not open the uterus until three months after its removal, to allow for adequate hardening to take place. When I did so I was surprised to find that a small but apparently normally formed foetus was present; that the placenta, in which vesicular degeneration had taken place, was in a position of a central placenta praevia; and that there had been a considerable amount of concealed bleeding between the membranes and the uterine wall. Sections of the placenta showed the normal appearance of a hydatidiform mole. There was no sign of active proliferation suggesting malignancy. Secretions from the thinned uterine wall, however, showed that there was early penetration of the muscle by the villi, which had not reached the peritoneal coat. The naked-eye appearances of the specimen are shown in the photograph (Special Plate).

Commentary

This case presents unusual features, in addition to the three coincident causes of ante-partum haemorrhage. One of these is the occurrence of a vesicular mole in the later stages of pregnancy; another, the presence of a well-developed foetus in relation to it. It is possible that twin foetuses were originally present, the vesicular degeneration having taken place in the placenta of one only. Finally, the case illustrates the value of hysterectomy in the treatment of severe cases of ante-partum haemorrhage.

Clinical Memoranda

A Triple Pregnancy with Extra-uterine Twins

(WITH SPECIAL PLATE)

The following case of an ectopic gestation in the pouch of Douglas and external to the generative organs seems to be worthy of record.

CLINICAL NOTES (E. H. R.)

A married woman aged 37 was admitted to hospital on September 7, 1936. She had had two children, the youngest aged 12, but no further pregnancies.

She had always been in good health; her periods had been normal, likewise the pregnancies and parturitions. She had complained of vague pains since January of that year in the lower abdomen, with amenorrhoea since June 26. For the last three weeks she had been vomiting; there had been flooding and labour-like pains in the lower abdomen.

On examination she was found to be blanched, and looked very ill. She was passing a good deal of blood. The temperature was 100° and the pulse 112. There was an irregular mass rising out of the pelvis to the level of two inches above the pubes. On vaginal examination a large and rounded mass was felt in the posterior fornix, which was pressing the uterus up in front of it.

SUBSEQUENT HISTORY

On September 10 she passed two fragments, about one and a half inches in diameter, which proved on microscopical examination to be much degenerated placental masses. Eight days later, her general condition having improved, an examination under general anaesthesia was performed. The uterine cavity was found to be four and a half inches long and displaced to the left of the pelvis.

The abdomen was opened on October 2, and a tumour the size of a croquet ball was found; it filled the right two-

* A case reported at a meeting of the Midland Obstetrical Society in December, 1936.

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FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

FIG. 9.

FIG. 10.

LEGENDS.—FIG. 1: Avulsion fracture of the os calcis. Accurate re-position usually followed by a good result. FIG. 2: Crush fracture of the os calcis with comminution and displacement—the type of fracture which presents difficulty both as regards period of incapacity and permanent defect. FIG. 3: Some months after arthrodesis of left subastragaloid joint. FIG. 4: Some months after arthrodesis of right subastragaloid and mid-tarsal joints. FIG. 5: X-ray result of crush fracture of the os calcis with comminution and displacement two months after injury. FIG. 6: X-ray three months after comminuted fracture of os calcis with displacement and involvement of the subastragaloid joint. Good clinical function. Treatment described in text. FIG. 7: X-ray some months after a crush fracture of the os calcis, showing subastragaloid arthritis and deformity of the os calcis, comparatively short disability, and eventually no symptoms. FIG. 8: Same case as Fig. 9. There is subastragaloid arthritis and deformity of the os calcis. At the time of the injury this side was unnoticed and it was not treated. He makes no complaint of it. FIG. 9: X-ray taken many months after the fracture. Note the arthritis and deformity. This foot was treated in a walking plaster. He has the usual complaints. FIG. 8 shows his other foot, which was similarly injured. FIG. 10: Subastragaloid arthrodesis performed in 1932. X-ray, 7/9/35, shows result and also the amount of arthritis which has since occurred in the mid-tarsal joint. There has been no improvement in his working capacity.