THE CARE OF THE TUBERCULOUS SOLDIER.*

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IN this paper I propose to bring before the conference the steps which are being taken in Great Britain to treat and assist the soldier who has acquired tuberculosis in the service of his country or whose disease has been aggravated thereby. Our allies may have adopted methods which differ in part at least from those in vogue in this country, and a consideration of such differences may be of material value in indicating the directions which our further efforts should take.

A year ago, in an article published in the journal, *Recalled to Life*,¹ I sketched out the proposals and plans which the Ministry of Pensions then had in view. In the present paper, based on my former article, I propose to bring the position up to date, to state what is being done and to indicate what there remains to do.

The problem is a vast one. Up to the end of last year about 20,000 men had been invalided from the British army suffering from pulmonary tuberculosis, and each year the war continues large numbers will be added to the total. The national importance of the problem is also heightened by the fact that too often a case entails suffering, not only upon the patient himself, but also upon those near and dear to him, thus augmenting suffering and greatly increasing the cost of treatment.

Need for Careful Examination of Recruits.

In considering the subject, we must first ask ourselves whether every care is exercised to limit the problem by seeing that men already suffering from tubercle are not admitted into the army. In the past this has not been the case. Men have been passed into the army who had previously been inmates of sanatoriums and had suffered from consumption. Of these, not all break down again, the result depending much on the hardships to which they may or may not be exposed, but many certainly do succumb after a longer or shorter interval and are invalided from the service, thus entailing great expense to the country in treatment allowances and pensions. It is clearly wiser, therefore, to exclude such men from the army, leaving them to continue their work, which may be of great value to the country, in their more sheltered civilian capacity. Great care must be exercised, therefore, in examining recruits. Histories of previous pleurisies and haemoptysis must be carefully inquired into and investigated, and the assistance of tuberculosis officers and others who have experience in the diagnosis of diseases of the chest invoked in any case where doubt or difficulty arises. The need of care in this respect is now more generally appreciated, but it must be constantly borne in mind, in the interest both of the country and of the individual recruit.

But if all such cases of obvious tuberculosis could be eliminated from the army we should still have a vast problem to deal with, for to the war itself must be attributed a large proportion of the cases of phthisis with which we have to deal. Modern research teaches us that nearly every adult is already infected with tubercle. Under normal circumstances the natural immunizing processes are sufficient to prevent the spread of the infection, and most of us carry the poison through life without harmful result. But under the strain of active service it is different. The soldier's strength becomes sapped by exposure and strain and his vitality diminished, and under these conditions the tuberculous focus, which might otherwise have remained for ever dormant, wakes into life, and signs of active disease, for the most part affecting the lungs, make their appearance.

Direct infection has no doubt also played its part in the spread of tuberculosis which we are considering. The close proximity of man to man, inseparable from life in tents and the unavoidable overcrowding sometimes met with in billets or huts, must have presented many oppor-

tunities for massive infection and consequent danger when a case of consumption has developed under such conditions.

Need for Early Diagnosis.

The next point which must be borne in mind is the necessity for early diagnosis, when once signs of pulmonary tuberculosis begin to manifest themselves, if we are to obtain the best results from treatment and prevent the further spread of the disease. In view of the insidious onset of the malady in so many cases this is by no means easy, especially under conditions of active service. The members of the Royal Army Medical Corps must, therefore, ever be on the watch for the disease, and when signs of lassitude, cough, and wasting make their appearance the man should at once be placed under observation, his temperature registered, and the sputum tested, not once, but many times. If this is done, in most cases the disease will be recognized early, and appropriate treatment will have the best chance of success.

Let us now consider what is being done in this country to secure for the soldier who has developed phthisis the treatment best suited for him in the different stages of his illness, and in the following pages pulmonary tuberculosis or phthisis will be especially considered, this being the chief problem with which we have to deal. It should be added, however, that treatment for surgical and other forms of tuberculosis is provided by the National Health Insurance Commissioners.

Treatment of Early Cases of Pulmonary Tuberculosis: Sanatorium Treatment.

As soon as it is evident that the patient is suffering from phthisis, or even when this is strongly suspected, he is sent home to one of the military hospitals in this country. If there is no doubt about the diagnosis he comes before a medical board, and in due course is invalided from the army, his further treatment being undertaken by the civil authorities. Before being discharged, however, from the military hospital, and in order to avoid delay in procuring him suitable treatment, steps are taken to arrange with the National Health Insurance Commissioners for his admission to a sanatorium, if he be an early case, or to a hospital if his disease be more advanced—every discharged soldier, whether insured or not, whose tuberculosis has, in the opinion of the invaliding board, been either "caused" or "aggravated" by military service, being now entitled, under arrangements recently made, to such form of treatment as his case requires. For this purpose a form (National Health Insurance, A.F.O. 1835), entitled "Application for Sanatorium Benefit on Discharge from the Army," is filled in, giving the man's name and intended place of residence on discharge, together with certain medical details in regard to his case. It is signed by the officer in charge of the military hospital, and forwarded to the National Health Insurance Commissioners of England, Scotland, Ireland or Wales (at the addresses given on the form), according to the part of the kingdom in which the applicant proposes to reside. Arrangements are then made by the Commissioners (under financial agreement between the Commissioners and the Treasury) whereby the soldier, now invalided from the service, is transferred, provided he be an early case and accepts the treatment, to a sanatorium, and this is, so far as possible, the institution with which the Insurance Committee of his place of residence has habitually made arrangements, and consequently, as a rule, not far from the patient's home.

Before leaving the hospital the case is also brought to the notice of the Local War Pensions Committee of the area in which the man will eventually reside. These bodies have now been established all over Great Britain, and one of their most important duties is to keep in touch with discharged soldiers and to assist them when in difficulty, and to obtain for them such treatment as they may from time to time require.

In the early period of the war not a few men refused sanatorium treatment in their anxiety to return home and see their relations and friends, from whom they had been long separated. This difficulty has been overcome by granting the soldier a fortnight's leave on full pay and allowances after leaving the military hospital and before entering the sanatorium. In other cases refusal of treatment may have been due, in part at least, to insufficient

* A paper read before the Inter-Allied Conference on the After-care of Disabled Men.

care on the part of hospital authorities in impressing upon the patient the necessity of accepting sanatorium treatment in the early stages of his disease. To give another chance to such patients, the Ministry of Pensions has made financial arrangements with the Insurance Commissioners whereby, if such a case is brought to their notice by the Local War Pensions Committee or otherwise within six months of discharge from the army, sanatorium treatment will be given with as little delay as possible.

Allowances during Sanatorium Treatment.

It was clearly useless, however, to expect men who may not feel very ill, and who are capable of some work, to accept sanatorium treatment should they feel that their families are in want as a result of their absence from home. It was decided, therefore, that whilst a man is at a sanatorium he shall be considered "totally disabled," and he is in consequence given an allowance at the maximum rate of pension, which, in the case of privates, amounts to 27s. 6d. a week (less a deduction of 7s. per week in respect of maintenance), together with a separation allowance of 13s. 9d. per week for wife, and of 6s. 8d. per week for the first child, 5s. for the second, and 4s. 2d. for the third and subsequent children, provided they are under 16 years of age. It may be added that, as provided by Article 4 of the Royal Warrant, if a man refuses to carry out treatment without good and sufficient reason, he is liable to forfeiture of anything up to one half of his pension.

Treatment at the Sanatorium.

During a patient's stay at a sanatorium he is kept in bed for a time, and as soon as it is clear that there is no pyrexia (or as soon as this has passed away), he is, at all well-run sanatoriums in Great Britain, treated by a system of graduated exercise—the German Liege-Halle system, of which rest is the chief factor, having never found much favour in this country, except, of course, in febrile cases. The exercise prescribed is at first walking only, but such a monotonous occupation is gradually replaced by light and useful work, increased little by little until at last, before their discharge, the most favourable cases do six hours' hard navy work a day.

As a result of this treatment the patient, when the course is finished, returns home with his muscles in good condition and able to resume work, but he must continue to carry out at home, as far as possible, the open-air lines of treatment which he has learnt at the sanatorium, if he is to maintain his health. He must also be careful not to overtax his strength in the early months after his discharge, and only gradually return to full work, and even then he should be in a position to take a day off from time to time, and to rest if he should not be feeling quite himself. This has been the great difficulty with the sanatorium patient in the past, his "benefit" payment from his friendly society ceasing as soon as he returned to work of any kind, even for an hour or two a day, so that it has been incumbent on him to work at once "full time" if he is to earn his weekly wage and thus to support himself and his family. The ex-soldier is, however, in a happier position. The Minister of Pensions, recognizing the position, and appreciating the fact, accepted by all life assurance societies, that a man who has had consumption can never be regarded again as the equal of one who has not suffered from this malady, has taken steps in conjunction with the Ministry of National Service to see that all medical boards at which the soldier's pension will hereafter be reviewed, shall be furnished with the opinion and advice of the medical superintendent of the sanatorium (if the patient be still at the sanatorium when the board is held), and afterwards of the tuberculosis officer, who will have the future care of his case, and who will be conversant with his condition, so that the man's pension will be properly graded according to his working capacity, in so far as this is affected by his tuberculous disease. This is a matter of vast importance, and the Minister's wise and just decision will in future afford the patient a greatly increased chance of maintaining arrest of his disease.

Advice as to Work and Occupation after Leaving the Sanatorium.

It may at this point be of value to refer to the important question as to the kind of work which the patient should

undertake on leaving the sanatorium, and the advice which should be given him in this respect, for upon a right decision in this matter his future health will largely depend. He will be a man who has probably had some former trade or occupation, and if this be not obviously injurious, the question often to be settled is as to whether he should return to his former occupation, which will probably offer him a good wage, even though this may necessitate his living in a city under "urban conditions." Some recent observations on the after-histories of patients who have left the Brompton Hospital Sanatorium, at Frimley in Surrey, are very instructive in this respect.² They would seem to show that the outlook of patients with limited disease who leave the sanatorium with their malady arrested, and who return to urban life under fairly satisfactory conditions, is infinitely less hopeful than the outlook of similar cases who have been able to effect a change of environment into the country, and sometimes a change of work. If possible, therefore, a return to town life should not be sanctioned, but in advising on the matter we must ever bear in mind the wage to be earned from any form of work proposed, for it is of paramount importance that the man should obtain from his work, supplemented by his pension, a sufficient income to enable him to be properly fed and adequately housed. Without this the most ideal climatic conditions will not save him from a breakdown and renewed activity of his disease. The work also must not be of too arduous a nature.

For this reason the advice so often given, urging the patient to give up his former occupation and to undertake, without any previous experience or training, the work of an agricultural labourer, is generally mistaken. The wages are not high, the housing accommodation is too often very poor, and the work is often exceedingly arduous. It is carried on under conditions of great exposure, and the hours at certain seasons are very long. As a result, only the exceptional case can stand it without breaking down, and it is not suitable for the average consumptive on leaving the sanatorium. We may add, too, that it is not a life which possesses great attractions for the former town-dweller.

In many cases, owing to the difficulty of finding a totally new occupation, and the fact that under such circumstances the man will at first be untrained, and therefore capable, for a time at least, of earning only a low wage, probably the wisest course is to allow the patient to return to his former avocation, provided it be not, like coal-mining, clearly and obviously unsuitable to a consumptive patient, *changing, however, the environment whenever possible.* To quote from my former paper:

Thus, a clerk may return to his clerical work, but should obtain, if possible, a post in the country or at the seaside. Similarly, a bank clerk may often be transferred to a country or seaside branch. A railway porter should apply for removal to a country station, and a policeman to a suburban division, while a carpenter may obtain work as an "estate carpenter." In this way the patient is often enabled to return under good conditions to his former work, in which he is skilled, and can thus earn a better income than if he attempted a change of occupation. He has accordingly more money to spend in food, his vitality remains good, and his chances of keeping well are increased.

Should it be necessary, however, to find a fresh occupation for a patient, then one must be chosen in which the work is carried on under satisfactory conditions, and as much in the open air as possible. Whenever possible, too, the employee should be to some extent his own master in regard to the number of hours worked each day, and the ability to take a day off from time to time, should he not be feeling quite up to the mark. In this way his strength is conserved, and the danger of a breakdown lessened.

In deciding on the exact occupation the various trades should be considered. For example, in the building trade the work of a painter or decorator, a builder, a bricklayer, a carpenter or joiner may all be permitted, by preference, however, in a smaller rather than a larger town. Similarly, wood-carving or wood-road laying may be suitable. In the transport trades a man might take up the work of a coachman, cab-driver, chauffeur, taxi-cab driver, motor-van driver, or motor cleaner; but experience shows that the work of an omnibus or tram conductor or driver is too arduous in these days of large vehicles and rapid driving. Railway ticket collecting and some forms of mechanical work on the railways should also be suitable.

Certain lighter forms of work on the land may also be recommended, such as market and flower gardening, fruit growing, hurdle-making, forestry, and woodman's work. The work of a gamekeeper, park ranger, park attendant, or lodge keeper is also excellent, but the number of such posts is limited. Other light occupations which may be mentioned are those of a

traveller, an insurance or commission agent, rent collector, canvasser (though in individual cases they may involve too many hours' walking), commissionaire, and bookstall attendant.

Should in any case the larynx be affected, an occupation involving much talking is to be avoided. Similarly, if the case be one liable to superadded attacks of bronchitis, then the less exposed occupations must be chosen. Window cleaning is not to be recommended, owing to possible risk of hæmorrhage.

The above list of occupations is by no means exhaustive, and is given only as an indication of the kind of occupation which may be recommended. If the ex-soldier's occupation is thus changed, it is probable that, for a time at least, there may be some loss of income, but, as already pointed out, this will be taken into account when his pension is reviewed from time to time, in so far as the medical board is satisfied that the man's physical condition is affecting his normal working capacity.

The Value of Health Visitors.

A change of environment, and sometimes of work as well, such as we have recommended, is not, however, to be accomplished by the stroke of a pen, and certainly not without taking all the circumstances of the man's family and home surroundings into consideration. For this purpose the services of a health visitor who has had training in social work, as well as practical experience at a tuberculosis dispensary, have been found of great value. It is her duty, while the patient is at the sanatorium, to visit his home and to make herself acquainted with the circumstances of his family. Should the medical superintendent of the sanatorium, after becoming fully conversant with the man's case, advise a change of work and environment, it is her privilege, in co-operation with the Local War Pensions Committee and the Tuberculosis After-care Committee, where such exists, to help him to effect the change, and very often her efforts will be successful. Later it will be the duty of the health visitor to visit the home from time to time, to see that proper precautions are carried out and that the man reports himself to the tuberculosis officer for examination at regular intervals. She will also arrange for the examination of contacts, and give friendly counsel in regard to the occupation chosen for the children, bearing in mind their predisposition to the disease.

Health visitors such as these already exist in certain areas and are doing excellent work, and a proposal is now being considered by the Ministry of Pensions and the Local Government Board to establish them generally throughout the country, so that the tuberculous soldier may obtain the maximum benefit from the treatment which he is entitled to receive.

Treatment of Advanced Cases.

After the patient has returned to work he is kept under observation by the tuberculosis officer, the health visitor seeing that he reports from time to time for medical examination. Should he show signs of breaking down, it is the duty of the tuberculosis officer to obtain for him, through the Insurance Committee, the treatment which his case requires—possibly a further course of sanatorium treatment, possibly treatment at home under his panel doctor, or possibly a spell of hospital treatment.

A time will come, however, in most cases, when the disease becomes advanced, and the patient bed-ridden and totally incapacitated. He is now in urgent need of medical treatment and careful nursing, and it is a time when, in the interests of his wife and family, in order to avoid the risk of massive infection, which at this stage of the disease is a grave one, he should receive institutional treatment. Such cases in the past have too often drifted into the Poor Law infirmaries—when they have not declined such treatment and elected to remain at home, with all the attendant risks and consequences of their families—since provision for such cases is not generally made under the Insurance Act. To prevent this unsatisfactory state of affairs, provision of "advanced beds" has been made by the Minister of Pensions.

Arrangements in the first place have been entered into with the Metropolitan Asylums Board, whereby up to 150 beds have been made available in the hospitals under their charge in the various London districts for the treatment of such cases, which must be certified as "in need of residential treatment, though not likely to recover a reasonable degree of working capacity." At present three wards, containing 64 beds, have been opened, and as the necessity arises more will be placed at the disposal of the Ministry. The Metropolitan Asylums Board is responsible for the maintenance and treatment of the patients, the actual cost being paid by the Ministry. The arrangement has

worked excellently, and the Ministry is indebted to the Metropolitan Asylums Board for the valuable help which it has given in this matter. The patients have been admitted without delay, have been well and sympathetically treated, and not a few have stayed until they died in the institution. As the patients for whom these beds are assigned are drawn from London and the adjoining counties, they are not too far removed from friends, who can visit them from time to time, and a sense of isolation is thus avoided.

In other parts of England beds for advanced cases are also being provided. At the Walker Gate Sanatorium, Newcastle, and at the Ottingham Sanatorium, near Hull, 15 beds at each institution have been placed at the disposal of the Ministry, and at Bierley Hall, Bradford, and at the Fazakerley Sanatorium, near Liverpool, 60 and 30 beds respectively will shortly be available. At the Cambridgeshire Tuberculosis Colony, at Papworth Hall, some ten miles from Cambridge, the Pensions Ministry has also obtained a lien on 40 beds, some of which will be used for advanced cases. In addition, small pavilions to accommodate 12 beds each (in the case of Birmingham 24) are being erected in the grounds of existing hospitals and sanatoriums—namely, at St. Helens, in Lancashire, at Birmingham, Derby, Southampton, Bristol, and Exeter, and these will shortly be in occupation. Towards the cost of the erection of these buildings the sum of £10,000 has been generously placed at the disposal of the Ministry by the British Red Cross Society and the Order of St. John of Jerusalem. The pavilions so erected, as well as the beds at the various institutions referred to above, will serve not only the urban districts mentioned, but also the surrounding areas, and the patients admitted will not be separated too far from relatives and friends.

It is interesting to note that in France our allies recognize equally with ourselves the importance of providing hospital treatment for the advanced tuberculous soldier, alike in the interest of the patient himself and with a view to preventing the spread of infection to his family, in this last and most dangerous stage of the disease, and that the erection of a hospital for this class of case is in contemplation by the French Red Cross Society.

Farm and Training Colonies.

In conclusion, I must say a few words in regard to farm and training colonies. In discussing the question of the work which a patient should take up after leaving the sanatorium, I have indicated that there are certain occupations, such as coal-mining, which, though not unhealthy in themselves, are clearly unsuitable for the consumptive. If the patient's previous occupation has been of such a nature, he must, therefore, perforce effect a change. A certain number of such patients may have had some previous knowledge of the land and be desirous of undertaking training in agricultural work, and for such as these farm colonies are being started. To these institutions the selected patients will be drafted direct from the sanatorium, and at them they will stay a year, since adequate training cannot be given in a shorter time. During this period treatment will be continued, and the patient will also be trained in agricultural work, market gardening, pig-keeping, bee-keeping, poultry-farming, and dairy work, together with rough carpentry and metal work, so that at the end of his stay he will be in a position to undertake work on the land either in this country or the colonies, or if he should eventually find other work, he would possess the requisite knowledge to cultivate an allotment with profit and success. During his year's stay the arrest of his lung disease should be rendered more secure.

Such colonies are a new development and are still in the experimental stage, for it is not known whether, under the existing conditions of the labour market, when well-paid work is so easy to obtain, men will be content to remain a year at a colony, nor can it be said as yet with certainty how far the after-history of a colonist, trained and treated as above, is better than that of a man who has simply passed through the full course of graduated labour at a first class sanatorium, and returned to suitable work in good environment at the end of his three or four months' treatment. This being so, and as the cost to the country of treating and training a patient at such a colony for a year will be considerable, the Ministry of Pensions is proceeding carefully in the matter, but if such colonies prove successful the scheme will no doubt be extended.

At present four such colonies are being started. They are as follows:

1. The Red Triangle Colony, at Kinson, five miles from Bournemouth, under the management of the Young Men's Christian Association. (21 colonists.)
2. The Cambridgeshire Tuberculosis Colony, at Papworth Hall, some ten miles from Cambridge, at which the Ministry

has a lien on 40 beds, some of which will be available for colony patients.

3. The colony now being inaugurated through the generosity of Mr. R. A. Pilkington in connexion with the Liverpool Sanatorium, in Delamere Forest. (30 colonists.)

4. The Royal Victoria Farm Colony, Polton, near Edinburgh, originally started by Sir Robert Philip. (Possibly 100 beds.)

Each of these colonies will probably develop on slightly different lines, as dictated by local conditions. At Kinson and at Edinburgh the colonies, as at present advised, will be purely agricultural. At Delamere Forest it is hoped that, through the good offices of H.M. Office of Woods and Forests, training in forestry will also be given, for which there will be full scope after the war, and it is possible too that training in a trade, such as clog-making, may be provided for certain of the colonists. At Papworth, under the energetic management of Dr. Varrier Jones, there will be training in agricultural and gardening work, but carpentering and engineering shops are also being erected. In the latter a course of instruction will be given, having as its basis the agricultural motor trade, such motors being now much in request in the agricultural counties adjoining Papworth, and the work of driving such ploughs having been found suitable for the patients. The colony at Papworth bids fair, therefore, to develop into a training colony rather than a farm colony pure and simple.

Such variation is all to the good, and will help to show on what lines the movement may best attain permanent success.

The patients sent to the colonies by the Ministry will be carefully selected, and will be those with early disease, in whose sputum tubercle bacilli have been found, or who have had a definite attack of haemoptysis or pleurisy with effusion, thus leaving no doubt as to the correctness of the diagnosis. The patients will be received direct from the sanatorium, and must be capable of working at least six hours a day without pyrexia, malaise or undue acceleration of pulse. They will engage to stay a year at the colony. During their stay payments for maintenance and training will be made by the Ministry on behalf of patients whose cases have been accepted by the Ministry at rates agreed upon between the body responsible for the management of the colony and the Ministry. The individual patient will also be entitled to the following benefits: During the year of treatment and training the man's

pension will be in abeyance, but he will receive instead an allowance at the rate of 27s. 6d. per week, from which a certain amount will be deducted weekly towards the payment of his board and lodging. Out of the balance it is proposed to pay over to him 5s. weekly, leaving the remainder to accumulate for his benefit until he leaves the colony, or, should he desire it, the balance may be paid weekly to such dependants as he may name. In addition to the above allowance, the colonist will be entitled during the last six months of his course to a weekly bonus of 5s. per week, provided that he completes satisfactorily the full year's course of treatment and training. This bonus will be paid to him at the termination of his year's course.

At the Kinson Farm Colony it has been decided (and possibly similar arrangements may follow elsewhere) that at the end of the twelve months' course the colonist will also receive a small sum, representing half the net profits (as apportioned among the colonists) which it is hoped may accrue from the successful farming operations of the colonists, the exact amount depending largely upon their individual efforts. The remaining 50 per cent. will go towards defraying the cost of the maintenance of the colonists.

Such are the lines on which farm or training colonies are being developed in this country, and it is hoped that these institutions may be the means of giving a fresh start in life to many a deserving patient, who might otherwise drift downhill by returning to unsuitable work amid unsatisfactory surroundings. In association with the other measures already taken for the proper care and treatment of soldiers whose tuberculosis has been caused or aggravated by military service, they are also an earnest of the firm resolve of the Minister of Pensions to spare no pains and to save no effort in his determination to do all possible to help these most deserving men, who have jeopardized their health in the service of their country.

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¹ Tuberculosis in its relation to the war, *Recalled to Life*, No. 2, p. 254. ² W. O. Meek, The value and limitations of sanatorium treatment as regards the working classes, *Lancet*, 1917, vol. ii, p. 785.

REMARKS ON ROENTGENOGRAPHIC PELVIMETRY.*

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IN considering the use of the Roentgen rays in the diagnosis of pregnancy, and in the prognosis of difficult labour, attention is to be paid to the size and shape of the mother's pelvis and of the fetal head, and also the relation of the one to the other. This paper deals chiefly with the former, as in the majority of cases the abnormal presentation is due to pelvic deformity rather than fetal abnormality.

Since the existence of contracted pelvis was first reported by Arantius various methods have been employed for diagnosing the existence and measuring the extent of pelvic deformity.

External pelvimetry, introduced by Baudelocque, while enabling us to measure directly the external pelvic diameters, and thence to draw certain conclusions as to the degree of contraction, is insufficient for estimating the size of the pelvic cavity. This cannot be done directly in the living woman.

Internal Pelvimetry.—A method was devised by Skutsch which makes it possible to estimate the size of the pelvic cavity indirectly and with fair accuracy, but as the employment of his instrument is usually painful to the patient, an anaesthetic is required if an accurate diagnosis is to be made.

The Roentgen rays, it was thought possible, might afford a valuable method of investigating the size and shape of the pelvis, but it was found that, while an excellent idea as to shape was obtained, that as to size was erroneous,

owing to the fact that the sacrum and pubis lay at different levels from the sensitive plate, and consequently one portion of the pelvis was enlarged out of all proportion to the other. This defect made it impossible to utilize the radiograph for purposes of mensuration.

The employment of the following method will obviate this difficulty, and make it possible not only to see the existence and extent of the pelvic contraction both of the inlet and outlet, but also to compare it with the normal pelvis, and measure its degree without causing much inconvenience to the patient.

Method.

In a normal pelvic bone, which is designated the "standard pelvis," the various diameters, both external and internal, are accurately measured. When this bone is radiographed definite points can be marked on the plate; the distance between these points will bear a definite ratio to that between the corresponding points measured on the pelvis. This radiograph is taken as the "standard plate." By radiographing the patient in the same position as the "standard pelvis," having the points of focus the same, the x-ray tube at the same angle and the same distance from the sensitive plate, an accurate comparison of the patient's plate with the "standard plate" will be obtained, and therefore of the patient's pelvis with the "standard" or normal pelvis; from it the internal measurements can be mathematically worked out; when compared to the direct measurements they are fairly accurate, as is shown by Figs. 1 and 2, there being an error of 2 mm. only. To work out mathematically the transverse diameter, for example, of the pelvic inlet the length of the transverse diameter of the pelvic radiograph of the patient is multiplied by the transverse diameter of the standard pelvis, and divided by the transverse diameter of

FIG. 1.—Drawing from skiagram of a normal pelvic bone, "standard pelvis."

FIG. 2.—Drawing from skiagram of an abnormal pelvic bone.

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