She recovered from the operation well, and, although she had a good deal of pain in the pelvis and thighs, there were no bad symptoms. The temperature never rose very high. On December 28th the urine was passed four times easily in the twenty-four hours and the wound was looking well. On December 30th there were symptoms of intestinal irritation which could not be accounted for, but were cleared up by the passage of an *ascaris lumbricoides*, which may also, perhaps, throw light on the continuation of the slight rise of temperature. After the administration of *santonin* and the expulsion of several worms the condition of the patient improved. At one time there was much swelling around the right sacro-iliac joint, which extended down the gluteal region. An exploring needle was passed into it with no result, and the swelling subsided shortly afterwards under simple treatment and rest.

The patient was discharged from hospital on March 6th, 1893, and was then able to walk across the ward; the symphysis had united firmly, and there did not seem to be any tendency for the bones to yield in reaction to the body weight.

Photographs of the patient at this time—kindly taken by Dr. Gray—show the extreme deformity of the pelvis and abdomen; they did not seem to be in any way different to what was present before the operation. It is doubtful whether the crowding down of the lumbar vertebra be due to congenital non-development or rickets rather than to the osteomalacia, but there is no doubt that the extreme curvature of the sacrum and the projection of the symphysis seen in lateral view are the results of the latter disease.

It has been difficult to look favourably upon the recent revival of symphysiotomy, as it has hitherto been so widely condemned by eminent authorities as a distinctly unscientific and unjustifiable operation. I think, however, it is now becoming recognised. The case I have recorded is an example of an unusually rare occasion in which it would be applicable; in fact, it was the only way in which the patient's life could be preserved.

I have since performed another symphysiotomy on a woman who had a rickety justo-minor pelvis, the pelvic diameter being about $2\frac{1}{2}$ inches and the outlet small. The result was not so satisfactory, for the perineum and the anterior fourchette were lacerated during extraction by forceps, but the patient is doing well, and I cannot give an opinion on the ultimate results. The question whether symphysiotomy should be performed when the outlet is small must be left to the judgment of future experience.

Professor Pinard has recently reported cases in which this operation was done for true rickety contraction in which the capacity of the outlet would not interfere with extraction of the head when once it has passed the brim.

A report of these patients in the future with regard to subsequent pregnancy and labour will be interesting. The operation is not a difficult one, and, under proper precautions, its immediate effects are not serious, but it of course requires expert judgment to decide in what cases it should be done. Most of the cases of difficult labour which would come under the possibilities of symphysiotomy in this hospital owe the contraction of the pelvis to osteomalacia, which is enormously prevalent in Bombay. The contraction of the cavity and outlet which that disease produces precludes the delivery of a live child as a rule and leaves no choice except between craniotomy, embryotomy, or Cæsarean section. In the case recorded there was not even this choice. It is, I believe, historical, as I have never heard of the operation having been performed in India before. The patient has since called at the hospital, and walks as well as she did before the operation, the pelvis being firmly united.

PULSUS PARADOXUS IN ACUTE LARYNGITIS.

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My attention has of late been drawn to the occurrence of pulsus paradoxus in children suffering from dyspnoea due to acute laryngitis, whether membranous or simple. Since I

first noticed the presence of this symptom in such affections, in every case of laryngitis, nine in all, brought to the casualty room of the Birmingham General Hospital, in which the obstruction in the larynx was sufficient to cause recession of the chest during inspiration, I found that the pulse invariably became small and feeble during the same period.

As the disease progressed, the symptoms became more and more marked until just before tracheotomy was done in those cases requiring it, when the pulse was found to be almost imperceptible during inspiration.

The moment the trachea was opened and air allowed to enter freely into the chest, the pulse resumed a regularity in volume and rhythm. It was also present on admission in a case which improved in a steam tent without operation, disappearing, however, as the child got well.

Having now had the opportunity of observing the occurrence of pulsus paradoxus in several cases, and being unable to find any mention of it in connection with acute laryngitis in the English standard works on medicine, I thought it worth while to draw to it the attention of other observers who may not have already noticed it, and also to point out those points in connection with it which seem to be of most importance and likely to be of most use from a practical point of view.

The extent to which the pulse disappears during inspiration varies directly with the severity of the affection; and as the recession of the lower half of the chest also varies according to the amount of the obstruction to the entrance of air into the chest, the former symptom may be taken as an indication of the presence of the latter. A recognition of this point does away with the necessity of exposing the child's chest in a cold room. As the disease progresses and the patient gets weaker, the pulsus paradoxus becomes more marked and more persistent, although the amount of the recession may not have increased to a proportionate extent. This is probably an indication of the heart having become weaker and less able to overcome the extra amount of work, which, as I shall attempt to show later on, is thrown upon it. When the symptom becomes more marked without the recession of the chest increasing, it is an indication for operative help; for in the struggle for life which will be severe, the strength of the heart must be nursed, and all extra work for it be obviated as soon as possible.

So far I have not been able to attach any prognostic value to the condition of the pulse in acute laryngitis, nor does it seem to be of use in diagnosing between the membranous or simple varieties. The nine cases to which I have referred above were children under 2 years of age, but I have also met with the pulsus paradoxus in a boy, aged 11, suffering from laryngitis of a subacute nature, and in a man, aged 24, with obstructive dyspnoea, due to severe tonsillitis. Unfortunately I have no pulse tracings taken from laryngitis cases, owing to the difficulty in taking them from children, but Fig. 1 shows a tracing from the case of acute tonsillitis which occurred in an adult.

The variation in the rhythm and volume of the pulse during inspiration was first described by Griesinger in connection with inflammatory changes in the mediastinum, and was attributed by him to the direct action of new formed tissue adherent to the sternum pulling upon the aorta. Kussmaul¹ later on had two cases in which he found that there were no such adhesions, but that the pericardium was adherent, and he thought that this was sufficient to cause the symptoms. He applied the term pulsus paradoxus to this variety of the pulse.

At one time the symptom was considered to be pathognomonic of mediastinitis, but it has been observed in other affections. It occurs in simple pericarditis with effusion (Biermer², Traube³, etc.), in extensive pleural effusion (Meixner⁴), in mediastinal tumours (Petrina⁵), and in aneurysm of the thoracic aorta.

A diminution of the strength of the radial pulse during inspiration has been noticed by Jürgensen in acute pneumonia.⁶ In the chapter on Stenosis of the Trachea and

¹ *Berlin klin. Wochenschr.* 1873. No. 8.

² *Deutsch. Archiv klin. Med.* xiv., 653.

³ *Charité Annalen.* 1878.

⁴ *Vrtljchr. f. d. prakt. Heilk.* Prague, 1879.

⁵ *Prag. med. Woch.* No. 19, 1877.

⁶ *Croupöse Pneumonie*, Tübingen, 1883, pp. 244-45.

Bronchi in Strümpell's work on *Medicine* (vol. i, p. 208) the following passage occurs: "As regards the pulse, one occasionally observes during inspiration a distinct diminution of the tension and height of the pulse wave—*pulsus paradoxus*." Finally, it occurs occasionally in healthy individuals (Riegel), and I find that it can generally be induced in the latter by the subject closing his mouth and nose and then rather forcibly endeavouring to draw in his breath. Fig. 2 shows a pulse tracing taken from a healthy house-surgeon illustrating this.

stenosis or forced inspiratory movement with the mouth and nostrils closed, it is much more marked, lasts longer, and acts visibly on the volume and rhythm of the pulse, producing the *pulsus paradoxus*.

It is probable, therefore, that increased work is thrown on the heart in cases of acute laryngitis, and when this important organ is weakened as a result of the pyrexia and of the virus of the disease it naturally tends to show more signs of failing as the disease progresses.

In some cases—in children with a flexible sternum in whom

Fig. 1.—Pulse tracing from a case of acute tonsillitis. Patient began to take a deep breath at the mark X.

Fig. 2.—Pulse tracing from a healthy adult. The nose and mouth being closed, a forcible attempt at inspiration was made between the two crosses (X).

The causes producing *pulsus paradoxus* in acute laryngitis cannot be the same as in mediastinal affections, where new-formed inflammatory tissue acts in some manner or other on the pericardium and impedes the action of the heart, or on the great vessels at the base of the heart by constricting their lumen during inspiration. Some other explanation must be sought for, and I think it is to be found in the great variations of the intrathoracic pressure on the heart and great vessels in the chest cavity.

Normally at the beginning of inspiration there is a slight amount of negative pressure produced in the chest, owing, of course, to the cavity of the latter being suddenly increased without the air being able to enter fast enough through the glottis to fill the expanding lung. This passes off before the act of inspiration is completed; but if the glottis be stenosed the amount of negative pressure so produced is greater and its duration much longer, extending in some cases to the end of inspiration. In these latter cases the effect on the pulse is plainly marked.

The manner in which the increased negative pressure in the chest determines the variation in the rhythm and volume of the pulse may be briefly summarised. The blood in the vessels of the body generally is subjected to the action of the constant positive pressure of the atmosphere, so when a partial vacuum is created in the thorax there is a tendency for the blood to be aspirated into the great vessels there. This aids greatly the venous circulation of the body, but at the same time must of necessity tend to hamper the flow of blood in the large arteries. The two results to some extent counteract each other normally. The thin-walled auricles are more affected by the aspirating action of the negative pressure than are the ventricles; and here again the venous flow is aided, so that the heart receives a plentiful supply of blood—in fact, the contents of all the great veins and arteries near the thorax tend to flow to the heart.

The ventricles receive the blood from the auricles, and, on contracting the right side of the heart forces its blood without impediment through the lungs to the left side. It is on the left ventricle that the full force of the extra work falls, for it has to overcome, not only the normal pressure in the arteries, but also the tendency of the blood in the large arteries to flow backwards in the direction of the negative pressure. In other words, the heart has to pump blood out of a vacuum into positive pressure. This negative pressure is normally only slight and transient in its effect on the blood flow, but in abnormal conditions, such as laryngeal

the recession of the chest is extreme—one cannot help wondering whether direct pressure on the heart from the retracted sternum does not enter into the causation of the feeble beats. In the first case I saw this suggested itself to my mind, the recession being extremely well marked and the pulse at the wrist imperceptible during inspiration.

REMARKS ON ACUTE INFLAMMATION, ACCOMPANIED BY GREAT PAIN IN THE HEAD AND EYES, AND BLEPHAROSPASM,

OCCURRING SOME HOURS AFTER WITNESSING ELECTRIC WELDING OPERATIONS:

ITS PREVENTION AND TREATMENT.¹

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IN view of the advancing utility of electric appliances in the working of iron for various purposes, and having last March opportunities which had never occurred to me before in my experience for seeing no fewer than five cases affected in the eyes by the glare of electric welding of iron, I propose to give a short history of those cases, and to draw attention to the need of extreme care in exposing, or rather protecting, the eyes by scientifically-constructed glasses or shields when in the presence of such a dangerous light.

The principle of this system of welding, known as the Benardo system, it may be as well to state, in passing, consists in the concentration of a great degree of heat upon a small area by means of an electric arc between the metal to be welded and a movable carbon rod conveying the current. It is well known that the temperature of the electric arc is the highest that can be produced artificially, exceeding that of any furnace. A piece of steel can thus be brought to welding heat, or made to run like solder.

The other system is named the Thomson-Houston system, and consists of merely causing a current of electricity to flow through two portions of the metal which are to be united, and owing to the high resistance of the imperfect junction the joint is raised to a welding temperature.

¹ Delivered at a meeting of the Yorkshire Branch of the British Medical Association, held at Sheffield.