OXYGEN GAS AS A THERAPEUTIC AGENT.

By S. B. BIRCH, M.D., M.R.C.P. LOND.

THE gradually increasing interest manifested by the profession, conjointly with wishes recently expressed by personal friends, induces me to believe that a few practical observations on this subject may at present prove not unacceptable, or devoid of usefulness, to some of our members. I may fairly be permitted to offer a very few preliminary remarks, and then will endeavour to be as concise and practical as possible.

When I ventured in the years 1856 and 1857, after some careful experience, to re-introduce the subject of oxygen gas as a therapeutic agent, and to urge its reception and establishment as one of our most valuable remedies in many intractable forms of disease, the more highly scientific portion of the profession, almost to a man, met my views with the most uncompromising hostility. Dr. Beddoes and Sir Humphrey Davy, as well as Dr. Cavallo, had tried and failed; Drs. Hill and Thornton were either forgotten or ignored; in hospitals at home and abroad it had been tried and had failed; I was bringing forward "an exploded remedy dressed up in new colours," etc., etc. Few, indeed, were the bright gleams of encouragement afforded. Among these, however, it is my pleasing duty to record Dr. Alexander's reference to me in his able work on *Gout and Rheumatism* (1858); Dr. Francis in the *Lancet* (1858); and, among periodicals, the one hopeful exception in my favour, the *British and Foreign Medico-Chirurgical Review* (1858). In 1859, my paper read before our Association at Liverpool, and subsequently published in our JOURNAL, gave another impulse in the direction desired, and I had soon the pleasure of finding the subject attracting the attention of many practitioners both at home and abroad, and notably those two able experimentalists, Drs. Richardson and Demarquay. Great, indeed, has been the change in professional opinion regarding the therapeutic use of oxygen within the last few years, when I can now feel that an apology for advocating it is no longer demanded.

With the element of practical usefulness specially in view, it appears desirable, in the first place, to name the easiest and most economical methods by which oxygen can be promptly prepared and exhibited.

Although the use of chlorate of potash and peroxide of manganese is one of the best processes in an economical point of view, yet, for the busy practitioner, there is too much trouble in the management of apparatus for regulation of temperature, purification from chlorine, carbonic acid, etc. It appears to me that one of the best "rough and ready" processes which can be recommended, is the one originated (I believe) by Keller, and latterly modified by Fleitmann. A saturated (not milky) solution of chloride of lime, with a very small quantity of freshly prepared peroxide of cobalt* added, is to be subjected to a temperature of 176°; and the gas in tolerable purity comes off freely to the extent of 400 pints for each lb. of the chloride. To extemporise an apparatus for this purpose is obviously easy, and for administration a bladder can be readily attached, and some approach to accuracy thus attained in regulating the proportions of the oxygen and atmospheric air.

* The protoxide can be added at the moment of use, quickly becoming peroxide.

Mr. Robbins (Robbins and Co., Oxford Street) taking advantage of this process of Fleitmann, has ingeniously managed to combine and retain in dry powder the peroxide of cobalt with the chloride of lime, ready for immediate use by simply adding boiling (so directed) water to the compound. This affords two advantages: first, the good quality of the chloride is ensured; and, secondly, the trouble of making the clear saturated solution is avoided; while, with the simple inhaler devised by Dr. Beigel, the practitioner can administer oxygen at a distance from his residence, in a case of urgency, without the trouble of bulky and heavy apparatus. *Prima facie* it might be feared that sufficient chlorine, or at least hyperchlorous acid, would be disengaged to affect seriously the value of this quick and ready method; but so small is the real amount, that I would merely guard against its employment:—1. In cases of very sensitive lungs; 2. Where the decided taste and smell might be seriously unpleasant to the patient; 3. Where prolonged use in chronic disease may be required.

Solution of peroxide of hydrogen affords an easy and excellent (though rather expensive) substitute for the preceding, whenever perfectly pure oxygen may be demanded for immediate but limited use. At a comparatively low temperature (say below 100°) the pure peroxide in it readily parts with one equivalent of pure oxygen. It is but just to add that Robbins and Co. have paid more than ordinary attention to its careful preparation, which is a matter of great moment.

Various other processes for obtaining oxygen gas with tolerable facility might be here adverted to, but most (if not all) of them present something objectionable in a medical point of view. As a matter of professional interest, I will refer *en passant* to two. Take two parts by weight of peroxide of barium, and one part of bichromate of potash; then to this mixed powder add either an equal weight of bisulphate of potash, with about seven or eight parts of water, or else diluted sulphuric acid. The other process, viz., decomposition of water by galvanic battery, is at present a fancy one, but may some day be no longer so regarded, when electrical agency can be employed with less expenditure of material and time.

Having named the most ready means for the administration of oxygen by inhalation in cases of emergency and for limited periods, I must next draw attention to an older and more approved method which has several decided advantages, and through which I have mainly gained my own experience of the value of oxygen in disease. I refer to the apparatus and condensed gas in iron bottles invented by Mr. Barth, of Long Acre, London. With the disadvantages of the bottles being rather liable without care to get out of order, and difficulty of easy conveyance at a moment's notice—at least, in the country—there are the following great advantages. 1. The condensed gas is absolutely pure and devoid of taste and smell; and the large quantity of 120 pints is guaranteed in each bottle. 2. The apparatus is adapted for the most accurate and instantaneous measurement of due proportions of the oxygen and atmospheric air (a very important consideration, as I shall afterwards show); it is an excellent spirometer; and with it we can regulate with precision the patient's pulmonary movements, by a simple motion of the hand varying at will the pressure upon the lungs and the depth of each inhalation. As yet, I believe, nothing has been suggested equal in value to this apparatus with condensed gas, where prolonged employment of oxygen is required. So far back as 1856, in a brief note published in the *Lancet*, I called professional attention to this convenient and

accurate method of managing inhalation, which (it may be here noted) I have found equally available for nitrous-oxide gas in certain cases.

Having reviewed the best methods of employing inhalations of oxygen, it remains to notice its introduction into the system by means of the stomach.

1. *Oxygenated water*, which has latterly been used a good deal in France by Ozanam and others, as well as in this country, is highly to be commended in many cases; but I have very little reliance upon ordinary water charged with the gas. The only oxygenated water in which any confidence can be placed, is that which was patented by Barth some years ago, and which has been somewhat over-lauded in advertisement, notwithstanding its real merits. In preparing this water, all the atmospheric air is expelled by the conversion of the water into steam, pure oxygen gas then taking the place of the atmospheric air by being brought into contact with the steam under high pressure. Thus the water may be regarded as a saturated solution of oxygen, and, even when all the effervescing superfluity has disappeared, the water still retains all the gas upon which its virtue depends. The worst point in connection with this water is, that it is flat to the taste like distilled water, and that it has hitherto been found impossible (without exciting low vegetable organisation) to give it a slight piquancy, even with a mineral acid, except at the time of drinking.

2. *Nitrous-oxide water* is somewhat more pleasant to the taste, but not so generally useful as pure oxygenated water; although in some nervously-depressed and hypochondriacal patients I would give it the preference. It was twenty or thirty years ago the subject of a patent (Searle's).

3. *Solution of peroxide of hydrogen* has been recommended by Dr. Richardson for internal use. I am compelled to say that I find it only exceptionally useful; and there is an additional drawback in its unpleasant flavour of oxygen, to which patients much object. I will recur to the former point when speaking of the *modus operandi*.

4. *Ozonified oil*, discovered by Dugald Campbell, was introduced to the notice of the profession by the late Dr. Theophilus Thompson. Although it must not be regarded as a very general remedy, yet it has its limited sphere of usefulness, and ought not to have the stigma "rancid oil" attached to it. Where it does not disagree with the stomach, in some cases of rapidly increasing tubercular vomice and strumous ulceration generally, much benefit will occasionally be found from its use, other more approved remedial measures failing or demanding an auxiliary. For external use I have found it still more applicable; and in some few well-marked instances its superiority over other stimulating oils, as well as oils combined with ordinary stimuli, has scarcely admitted of question.

5. *Perchloric acid, chlorate of potash, and the permanganates*, may be rightly regarded as media for the conveyance of oxygen into the stomach. The first, hitherto little used, appears to exert a powerfully tonic and purifying influence upon the blood and secretions in some sanguineous but cachectic subjects (e.g. in anthrax), but it requires considerable circumspection in selecting cases for its administration. The second is well known for its valuable febrifuge and purifying properties. Permanganate of potash, now so valued as a deodorising and disinfecting agent when brought in contact with putrefactive matters, can scarcely be recognised for internal use, owing to disagreeable taste and astringent quality when administered in sufficient strength; except it be in passive hæmorrhage from the stomach or bowels in cachectic subjects, or as a gargle in foul conditions

of the mouth and throat. It is here specially named, because its transmission into the stomach has been in some quarters rather earnestly advocated.

Having in this first paper reviewed the principal methods by which oxygen gas may be administered, I hope shortly to offer a second paper on the *modus operandi* and doses under various circumstances, and afterwards to proceed to the therapeutic indications for its use, with illustrative cases.

ON THE PRECEDING AND SUCCEEDING CHANGES IN THE SECRETION OF THE KIDNEYS IN DIABETES.*

By JOHN GRANTHAM, Esq., F.R.C.S., Crayford.

In the second volume of the *Medical Times and Gazette* for 1858, page 243, I published the following statement; viz., that the function of the kidneys in malassimilation occurs thus. First, there is an elimination of the lithates; secondly, the phosphates; thirdly, the saccharine, unless there be fatty degeneration in the glandular system: then there is necessarily the albuminous condition of the urine.

In 1855, I attended a case of diabetes mellitus. The patient was a female, aged nine years, with pallor of the skin; muscles thin and flaccid; mentally depressed; very restless, with incessant thirst; tongue red; bowels constipated; urine increased in quantity, and irregular. I was informed that the father died in an epileptic fit, the result of delirium tremens; and that the patient was one of two children remaining after losing four others from epilepsy.

I made an analysis of the secretion of the kidneys, and found the following facts. Specific gravity 1028; colour pale straw; transparent; no traces of the urates in excess, nor phosphates or albumen. Under the microscope, I observed a few crystals; but there was unmistakable proof of the presence of sugar, both by Moore's and Trommer's tests, which, I infer, had succeeded the phosphates.

The treatment proved successful, which was a mixed diet, animal and vegetable, avoiding all kinds of saccharine fermentation; no fruit; also abstaining from satiating the feeling of thirst. I gave the nitro-muriatic acid in pure water, immediately before breakfast and dinner, in full doses. After twenty-one days of this treatment, I ordered the acetate of iron after the meals, enjoining daily exercise in the open air, and not permitting any mental occupation, which had the effect of removing the diabetic symptoms. The disease returned in the following spring and autumn, but in a less degree. She was in March 1858, and is at this time, in perfect health.

In the month of May, 1866, I was consulted in another case of diabetes, in a female aged 23 years, unmarried, who had long been the subject of general debility, attended with irregular colon law, which derangement incapacitated her from continuing any kind of employment during the last seven years. She had not experienced any relief from medical treatment, change of air, or regulation of diet. On examining the patient, I could not detect any organic lesion either in the chest or abdomen. She com-

* Read at the West Kent District meeting of the South Eastern Branch of the British Medical Association, at Dartford.