ON BURNS BY GUNPOWDER AND SCALDS BY STEAM.

By INSPECTOR-GENERAL SMART, C.B., R.N.

In a paper read before the British Medical Association meeting of South Hants, I related some observations on these points. Of the former category I dealt with twenty-one cases that occurred during our occupation of Canton in 1857, of which six proved fatal on the seventh, tenth, fifteenth, seventeenth, eighteenth, and thirtieth days respectively. I then detailed cases typical of the organic sequences that involved fatal results on the seventh day by meningitis, on the eighteenth by dysentery, on the thirtieth by exhaustion of nervous power with blood-poisoning, ending by ischuria, and one on the seventeenth by erysipelas attacking the head and face. I supplemented this by the details of a case that recovered, in which the primary violence was equally severe, but where these sequences were absent, and where constipation had been a characteristic of great prognostic value, as in all other favourable cases. The constitutional treatment was on the general principles observed in treating these complications when they present themselves idiopathically. The local treatment through all the cases was, in the first stage of depression and of inflammatory reaction, by carron oil on cotton wadding; in the second stage of suppurative action, attended by more or less sloughing, by oxide of zinc powder and by calamine ointment; and in the granulating and cicatrising stages by the same applications as in the suppurative; but when the granulations became pale and flabby, by strips of lint covered with resinous ointment containing an excess of turpentine. It was gratifying to find in the end that over two-thirds of them—all very severe burns of the head and face, with more or less of both upper and lower extremities—recovered.

Then exemplifying the subject of scalds by steam, by those that lately happened in the *Thunderer* explosion, I stated that out of thirty-four vigorous men who were in the stokeholes, only two remain alive, and, in addition to these, eleven have since perished who were not so near to the exploded boiler. In all about eighty persons were involved, of whom forty-five have perished by an explosion of steam and hot water that burst the boiler with the force of a thirty-five ton gun, scattering huge masses of iron, tons of boiling water, and volumes of steam, together with dense fumes from the extinguished fires. After an hour the living, fifty-eight in number, followed by nineteen corpses, reached Haslar Hospital. Of the latter fifteen had been brought up dead from the stokehole, and four had expired in the passage to the shore. Of the living, the majority were very severely scalded, but only one had received mutilation—of an ankle-joint, dying in four hours. Within thirty hours eleven others had succumbed to primary shock. Some of them were semi-comatose and little sensible to pain, others, after attempts to rally, became delirious, rolling heavily from side to side, and suffering from strangury, and stripping the dressings from their flayed limbs; breathing heavily, and vomiting. Those who survived the shock felt relief from scorching agony in thirty-six to forty-eight hours, gaining fitful sleep, passed excretions, and some asking for animal food. Possibly steam-scalding of fauces and of primary air-tubes, in those who died of the so-called shock within thirty hours, was the lesion of most fatal import. The stage of reaction for suppurative effort was attended by internal congestions and inflammatory action in the brain and along the gastro-enteric track, with their characteristic symptoms. Under such conditions six perished on the fifth, sixth, eighth, and ninth days from injury. On the tenth day there remained alive forty-four, of whom twelve have died, twenty-seven have been discharged, and five remain under treatment (September 12th).

One of these last cases, J. D—, was severely scalded by steam over the head, face, and neck, in the air-passages, and over the arms and hands. He had been exposed to the first rush of steam up through the casing of the funnel, and 350 square inches of his surface had been denuded of its cuticle or covered with large vesications.

On the sixth day all his unscalded surface was of a lurid red colour. He then became delirious, and had frequent fits of moaning, which lasted till the eleventh day, when he again answered coherently; but from the fifteenth to the twentieth he was again delirious, yet after that he recollected for the first time that he had been on board the *Thunderer*. In the meantime he had severe ophthalmia that had ulcerated both corneæ, the left irrecoverably. On the twenty-second day he complained of dysphagia, when the fauces were found sloughy and aphthous, and at the end of the fourth week gastro-enteritis afflicted him till the thirty-second day. On the fortieth day the kidneys were excreting bile pigment, sp. gr. 1.046, which state gave way to deposits of urates, phosphates, and, later, oxalates. He is now convalescent with, however, left staphyloma, and a few cicatricial contractions.

In another case that is recovering, the patient was scalded by steam to the extent of 400 square inches. He has had no signs of meningitis, but from the suppurative stage he has had attacks of gastric irritation, and that also of the kidneys, to the extent of excretion of albumen with broken blood-discs.

Such have been the two worst of the cases that have barely evaded the dangers which others have, only less in degree, gone through. In all, the results of nervous shock are well-marked in lowered courage and in dread of the past, from which time alone can restore them.

Sloughing of the deeper integuments has been rare compared with that in gunpowder burns, wherein delirium is of earlier access. On the other hand, early deaths from shock have been more frequent than in those burns, which may be attributed to the greater surface involved causing nervous depression, from which the reparative powers could not rally.

A scientific observer who had been witness of the results in two great magazine explosions remarked to me that 80 square inches of inflamed surface induced fever with danger to life. To test this assertion, I set a painstaking officer, Dr. Burke, to make approximate measurements of the scalded surfaces in twelve cases remaining in the seventh week. He found it, in square inches, to have been 198, 213, 232, 265, 283, 345, 355, 363, 377, 398, 477, and 766, giving an average of 356 square inches excoriated or vesicated. Of these the men now under treatment gave 198, 355, 363, 398, 477. All these had two points in common—the severity of the scald on the face and head, and sloughs, leaving indolent ulcers, on the arms, in which the new cuticle was very thin. The lowest, 198 square inches, was in the oldest man injured, aged fifty-three, who had a heavy struggle through the febrile reaction. The figures 355 belonged to the extremely dangerous case of J. D—, already detailed. The highest, 766 square inches, is altogether exceptional, as he could not have survived had the whole of that surface suppurated, much of it drying under the vesications. In him the scald was over nearly one-third of his surface. He is one of the two remaining who were in the stokehole, and he escaped into a coal-bunker, from which he was drawn insensible.

The questions of viability as dependent on the extent of surface involved, which determines the degree of shock, and again on the depth of tissue injured as taxing the reparative powers, are worthy of more precise observation. Perhaps in those who did not survive primary shock, the scald of the respiratory track, as well as that of the skin, precluded rallying; while in those who fell later, the depth, more than superficial extent, proved fatal, which may explain also a higher mortality from the sequences in gunpowder explosions than in severe scalds not directly fatal. I would view 350 square inches, the mean of these measurements of scalds, and 250 square inches of surface burnt by gunpowder, as equally fatal injuries.

As to the treatment. Until decided signs of rallying, it was by stimulants, with sago and beef-tea, anodynes of opium and chloral hydrate, chloroform to allay irritation of the stomach, and the use of the catheter. After rallying, beef-tea and animal food, where appropriate, were given night and day. Lime-water with milk was given to allay irritability of the stomach. On and after the third day, laxatives were given when required to relieve constipation, which was a most auspicious sign throughout, as animal food was then well borne, and the healing process went on rapidly. In treating internal complications, general therapeutics were observed. In those of the air-passages there were favour-

able results in the congestive stage, and pneumonia developed only in two cases, both fatal. The meningitic symptoms were beyond special treatment, and yet two such recovered, and several also in which delirium had been present. Gastro-enteritic symptoms ran high, but subsided more readily than the meningitic with the establishment of suppuration, but there were instances of recurrence at a later stage, in which one died with coffee-ground vomit. The renal disturbance was generally checked by alkalies and nitric ether. Great nervous prostration caused anxiety as leading to syncope, which was the mode of death in more than one instance in the suppurative stage.

The local treatment was by oil and lime-water on cotton-wadding on every part to the fourth and fifth days, and later, in the majority, on the limbs. This being found inconvenient on the face, head, and neck, it was changed for a wash over with carbolic oil (1 to 10), then dusting on it from a common flour-dredger a powder, consisting of one of oxide of zinc, one of magnesia, and two of powdered starch, sifted on wherever moisture appeared, care being taken to keep free the facial orifices. It formed a mask to the features, excluding the atmosphere. Under its protection the process of "scabbing" went on favourably, and, the crusts detaching, the scalds were found healed, except sometimes on the pinna of the ear, where abscesses gave trouble. In one case only is there any permanent deformity by cicatrices on the face, so that I think it applicable also in confluent small-pox. It was used also on some sores on the limbs, the forearms, and hands with success. Although only a mode of excluding atmospheric air, yet its claim is for simplicity and readiness of application. The treatment by oil and lime-water was in general disused before the tenth day; and when the above was not employed, it was substituted by a liniment of carbolic acid and olive oil (1 to 20) on lint under oil-silk, retained by bands of Lister's gauze, which, although locally successful, was not found free from a suspicion of irritating the kidneys.

To maintain the highest possible degree of atmospheric purity, almost every known deodorant was used; but preference was given to the process of Dr. Goolden, of disengaging chlorine, insensibly, from a mixture of nitrate of lead and common salt in solution, sprinkled on the floors from watering-pots, and on sheets hung round the offensive beds.

Very much has been due to the efforts by careful personal attention of the surgical staff, under the guidance and responsibility of Deputy Inspector-General Loney; for by them the duties, however humble, have been performed in a zealous spirit, regarding solely the welfare of the sufferers.

EXOPHTHALMIC GOITRE.

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WITH our limited knowledge of the physiology and pathology of the nervous system—a system which presides as the directing (originating?) force of every organic function—it is not by any means a matter of surprise that the unsolved problems of practical medicine should be so very numerous.

If it be the case, as indeed I think may fairly be assumed, that the initial cause of our every disorder or disease is to be found in some disturbance of the force above referred to, then may we well watch with an all-absorbing interest those investigations as to nerve-functions which our experimental physiologists are now pushing forward with so much ability, earnestness, and labour; for, until a larger amount of accurate knowledge, a greater weight of stable facts, a more determinate and determinable collection of positive information than we at present possess as to the effects of nerve-function, and the correlation of each special nerve-function on the purposes of *nutrition*, are placed within our reach, a correct interpretation of the phenomena of disease, and with this our ability to successfully treat disease, must necessarily be impeded—may be definitely obstructed by our ignorance.

How much is implied in the frequently-repeated expression—"some error of nutrition"—and yet how little do we

know of that force which creates and regulates nutrition. What knowledge have we of the several divisions into which the process of nutrition may be separated? Who can say whether that same much-talked-of "error of nutrition" lies in nutrition as a whole, or whether the "error" is dependent on a defect in some particular part of it? Is nutrition regulated by special trophic nerves not yet demonstrated, as first surmised by Samuel,* and subsequently supported by Duchenne, Bärensprung, and others of the same school of thought, or is it carried on independently of any such a system of trophic nerves, by the ordinary nerves of so-called organic life, thus making the nutritive integrity of tissues dependent chiefly on the nerves concerned in their several ordinary functions, as the observations of Vulpian and Phillippeaux would seem to indicate? All important questions these—so important indeed that until satisfactorily answered, our recognition of the causes of disease must inevitably be clouded and uncertain.

Can it be denied—I do not think it fairly can—that the facts of physic are comparatively few? And if so, then assuredly we should not be blind to this other fact—viz., that whatever the study of medicine may have hitherto taught us as to the general characters of disease, it is as nothing when compared with what we have yet to learn as to the essential and primary causes.

What do we know, for instance, of the *cause* of cancer? Recent discussions on cancer have been, it is thought by many, admirable in their fulness and lucidity. Descriptions of its every variety have been elaborated; the morbid appearances of various structures faithfully detailed; histological conditions graphically portrayed: but all this was only an oft-told and well-known tale; whilst it would seem to me to have been more desirable that the effort should have been directed rather to discover the *cause* of cancer than to describe its *characters*. The question should have been, I think, not, what is cancer, but what *occasions* it? And here might not disturbed nerve-function, in the matter of nutrition, step in to help us solve the problem?

Every organ, every tissue, must, in virtue of its own inherent force (nerve-function), attract to itself the necessary *elements* for its own maintenance and restoration. A simple error in point of *quantity*, if correct in *quality*, might lead only to hypertrophy, or the production of some homologous or analogous growth; whereas an error in the selection of the elements themselves, an error as to *quality*, would lead, it may be imagined, to the formation of a heterologous product. Just as some seeds sown in a soil not ordinarily their habitat display characters and possess qualities not originally theirs—characters and qualities not common to their ordinary nature; so *elements* not suited to the parts requiring maintenance and restoration may, in like manner, lead to a growth that shall prove destructive to the tissues in the midst of which it is situated.†

We know that cancer, as a rule, appears usually at that time of life when nutrition is difficult of adjustment, and when the balance is, so to speak, easily upset. Now, as a local excitant, a blow on the mammary gland might serve, by disturbance of nerve function, as the determining cause of such an error in nutrition as would in some instances, it may be supposed, lead to the *local* selection of *improper elements*, and thus produce a "nidus" eventuating in cancerous and destructive formations. This, however, is but a mere thought in passing.

Again, what positive knowledge have we as to the cause of that distressing condition now called, apparently by common consent, "exophthalmic goitre"? The first description of this affection, I suppose, may be fairly attributed to Demours, in 1818, and Galezowski‡ claims for this authority such pre-eminence; but still the affection has received many names in honour of the person who has been supposed to have first noticed and described it. It has been spoken of by Stokes as "Graves' disease," and Emmert gives the credit to Basedow.§ But by whomsoever first noticed, it does appear something more than strange that so very peculiar, so distressing, such an absolutely frightful collection of symptoms, should have re-

* Trophischen Nerven. Leipzig, 1860.

† Malignant tumour is formed of a collection of substances which are a new growth in the human body—of abnormal substances which do not exist in the body of the living man.—Dr. G. Buchanan.

‡ Etude sur le Exophtalmique, Gaz. des Hôp., 1871, p. 428.

§ Historische notiz über Basedow, nebst Reiterat über 20 selbst beobachtete Fälle dieser Krankheit. Arch. f. Ophthal., xvii., 203.