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SKIN CARCINOMA IN THE PROCESS OF 'STANFORD JOINTING'

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Three cases of squamous carcinoma resulting from exposure to mineral oil in the process of treatment of pipes known as 'Stanford jointing' are described, being the first to be noted in this process. The process itself is described with illustrations, and attention is drawn to the importance of realizing that such cases may occur in industrial processes where there is considerable exposure to mineral oil.

Exposure to mineral oil as a cause of skin carcinoma has received intermittent attention for many years. Among cotton mule spinners there has been a high incidence, and the whole position was extensively reviewed by Henry (1946). In the engineering industry incidence has been lower, but cases have been published by Cruickshank and Squire (1950) and various other workers, and figures for the general incidence were reviewed by Fife (1962). This latter paper gave the notifications due to tar and pitch, as well as mineral oil, together with the body distribution in industries other than cotton. These data show that the scrotum, followed by the hands and arms, were the sites involved in almost all the cases. The latest figures available of notifications to H.M. Chief Inspector of Factories in his report for 1961 total 167, of which 144 are due to pitch and tar, and 23 to mineral oil, industries other than cotton supplying 11 of the latter.

The carcinogenicity of mineral oils has been established through animal experiments by Leitch (1922; 1924) and by Twort and Ing (1928). The oils were those used on spinning mules, often known as 'spindle oil', but similar grades are used for lubricating purposes in other industries. This work has been considerably extended by the Carcinogenic Substances Research Group of Exeter, and it was reviewed by Cook, Carruthers, and Woodhouse (1958).

The occurrence of cases of skin cancer in widely distributed industries prompted the authors to record cases in another process in which the same materials are used but in which cases had not previously been recorded, *viz.* the treatment of certain earthenware pipes which are used as conduit for underground electric cable. This is known as 'Stanford jointing'. Of the three men concerned, case 1 was discovered as a result of his attendance at hospital for operation, following work at a factory which has now closed down, and cases 2 and 3 were discovered on enquiry at the principal firm doing this type of work. Prosser White (1934) in his well-known and comprehensive book refers to one pipe dresser and one bricklayer's labourer in contact with brick oil as suffering from skin carcinoma, and a reference in Henry's survey (1946) is made to brick pipe making. Neither of these cases, however, appears to relate to the actual process to be described, though in all probability the oil concerned was similar.

Case Reports

Case 1.—A man born in 1909, aged 50, was first seen at the Royal Infirmary, Blackburn in 1959 for a condition described as 'a large and very odd tumour of the scrotum'. This was stated to have begun as a 'boil' and to have taken 18 months to develop. The tumour was shortly afterwards excised along with one testis of which suspicions were entertained.

Histological examination showed the testis to be normal but the tumour was a squamous cell carcinoma (Fig. 1). There has been no recurrence after three years. In a predominantly cotton town, questioning naturally sought for some connexion with mule spinning. In fact, however, he had been employed for about 35 years in the earthenware pipe industry. He stated that, like his father before him, he was a 'Stanford jointer'. Out of about 40 men who at one time did this work, he is the only one known to have developed skin cancer.

Case 2.—A man born in 1899, aged 61, worked at 'Stanford jointing' from 1923 to 1940. He was seen by a doctor at work in 1935 and found to have 'a few papules

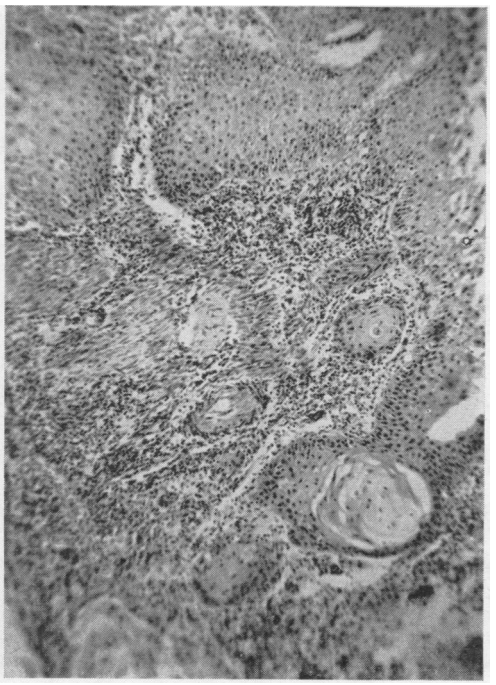

FIG. 1.—Case 1. Carcinoma scrotum, × 70.

FIG. 2.—Case 3. Carcinoma scrotum, × 70.

on the forearms characteristic of oil dermatitis'. In 1940 he developed a lump on the anterior aspect of the right forearm, about ¼ in. in diameter, which became ulcerated. This was excised at Holme Valley Memorial Hospital in 1941 after a clinical diagnosis of skin cancer had been made, and the specimen was examined at Huddersfield Royal Infirmary and diagnosed as 'squamous celled carcinoma of skin with ulceration and secondary inflammatory changes'. The man was then transferred to the Christie Hospital, Manchester for treatment, but though a recurrent lump at the site of the lesion was examined in the Christie Hospital in 1952, the treatment had been effective and this did not show malignancy.

His occupational history does not reveal any other likely contact which could be related to the condition.

Case 3.—A man born in 1903, aged 56, worked at 'Stanford jointing' from 1922 to 1945. He also worked for three years on a briquetting plant and for one year on mixing the Stanford jointing compound for use in an automatic machine. The contact with pitch dust was of moderate degree and that with tar in the jointing compound slight. The rest of his occupational history does not reveal anything relevant.

In 1958 he noticed four or five warty growths of the scrotum, which all dropped off except one. He saw his doctor, and in 1959 an appointment was made for him to see a surgeon. He did not keep the appointment as the wart appeared to drop off, but in fact a hard base was left which later ulcerated. He treated this himself until February 1962 when he saw his doctor because of a fractured toe, and mentioned the condition. He was sent to hospital at once and had part of the scrotum and testis removed. Section showed a squamous carcinoma (Fig. 2). He then had radiotherapy and later returned to work.

Cases 2 and 3 are the only two men from this firm to have developed lesions out of about 150 men exposed for a period exceeding five years during the time the process has been going.

Description of the Process

Earthenware pipes are made for underground electrical conduit, one end of each having a wider bore than the other, so that these pipes can be joined in series, the smaller male end fitting into the larger female end. In the jointing process a special jointing compound, which has the properties of being waterproof and slightly elastic, is applied to each end of a pipe, so that a permanent, waterproof, and moderately flexible seal is produced when one pipe is joined to the next. The jointing compound consists of tar 20%, sulphur 30%, and filler 50%. The tar and sulphur are melted together at 180°C., and when they have blended the cold filler (sand, crushed earthenware, or similar material) is stirred in. This brings the temperature of the compound down to about 120°C., at which temperature it is poured into the pipes which are held in metal moulds, so

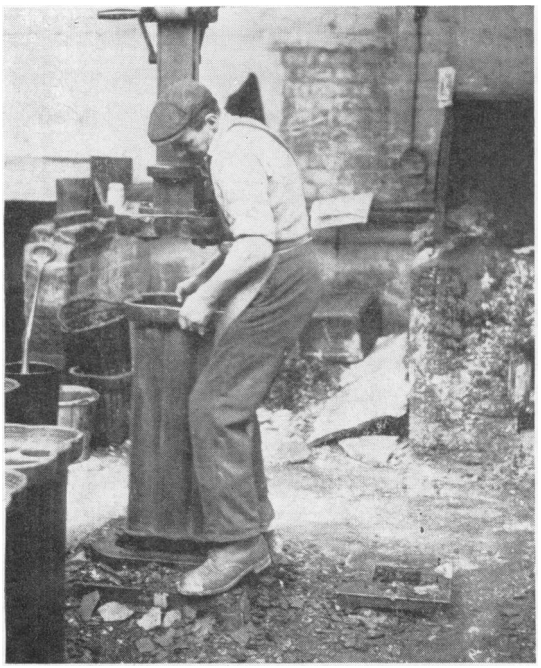

FIG. 3.—Handling the pipes on the lap.

FIG. 4.—Handling pipes.

that the jointing compound forms a layer half an inch thick outside the narrow end and inside the wide end of each pipe. Parts to which the compound must not stick, *e.g.* the metal mould and most of the pipe, are smeared with mineral oil known as brick oil or brick core-oil. The compound sets almost at once, the pipes are removed, and further pipes are treated in a continuous process. There seems little reason for skin contamination with tar as thick gloves are worn in view of the heat, and a long-handled ladle is used. Skin contamination with oil occurs, however, as the operator slops it over both mould and pipe with a dripping rag, and splashes go on to his arms and clothing. The work is about two to three feet from the ground, and thus the thigh and groin areas are particularly exposed to splashes, as well as the arms. Figures 3 and 4 show how oil gets on the lap area in the course of lifting the heavy pipes. This also may cause friction of oily clothing against the scrotum. Men have been inclined to stay on this work for many years, case 1, for example, being on it for approximately 35 years.

As regards the materials, the tar is an ordinary coal tar and, as such, would be potentially carcinogenic. The oil is a home-refined naphthenic crude, solvent refined, known as 100 tale spindle oil, almost exactly similar in type to that formerly used in mule-spinning. As far as can be ascertained, this type has always been used in the jointing industry, whereas the mule-spinning industry has gone over to 'non-carcinogenic' oils since 1953.

Discussion

The development of skin cancer as a result of exposure to mineral oil in these cases would seem probable in view of the details of the way application of the materials to the pipes is carried out. Exposure to tar would at first sight seem a possibility, particularly in relation to the forearms, but, as the tar is all in the liquid state and would be most unlikely to penetrate clothing so as to affect the scrotum, it can be virtually ruled out in at least two of the cases. In general, where scrotal lesions have been produced in persons exposed to tar or tar products, they have almost always been due to dust adhering to and penetrating clothing over a long period. Also of significance is the observation of oil acne of the forearms in one of the men five years before the development of his growth. The incidence of cases works out as three in some 200 men who have been exposed for more than five years. The average age of onset, 48 years, is rather lower than that in other industries where mineral oil is a factor, and the average length of exposure of 25 years is also rather lower. It is also not possible to be certain that these cases

represent the full incidence as cases may not have come to light for various reasons, and employment records are not complete. Also they are few numerically, so that it would not be fair to give definite comparisons with other industrial oil exposures.

The process in which these cases occurred has now been developed and mechanized, so that the likelihood of exposure in the future being sufficient to cause skin cancer is very slight. But it is of importance to draw attention to these rather specialized processes so that the possibility of the occurrence of skin cancer can be brought to the attention of both workers, managements, and works doctors. This was brought home very forcibly to one of the authors recently (J.B.L.T.) when he came across a case of cancer of the scrotum in a man exposed to both tar and mineral oil in the road-tarring industry. The case was the only one that had ever occurred at this particular firm, but the individual man had had three separate growths at different times, and the firm was apparently unaware that any hazard existed until it was brought to their notice after the third occurrence.

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