THE ARTHRITIC SEQUELÆ OF PNEUMATIC DRILLING*

By W. S. C. COPEMAN, M.D., F.R.C.P.

THE industries in which pneumatic tools are now employed are numerous and increasing. The chief amongst these are: mining, quarrying, road-making, shipbuilding, locomotive and other workshops, construction of all-metal aeroplanes, and shoe-making. The tools employed are pneumatic chisels, hammers, riveters, road drills, pounding and lasting machines.

Contrary to expectation, pneumatic tools have not been found to cause much occupational trouble.¹ The condition of "dead hand" is, however, a well-established vasomotor sequel of their prolonged use, and consists in a Raynaud-like syndrome showing tingling, numbness and coldness of the fingers, and in some cases of the whole hand. The report of the Chief Inspector of Factories for 1927 states that apart from the condition of "dead hand" there were few complaints about pains in the joints or muscles; and only one case of Dupuytren's contraction was observed. This is surprising in view of the nature of the work.²

There is no evidence that vibration by itself, without cold, can cause the vasomotor lesions.³ Riveting machines, indeed, have a cold-air exhaust (which may be covered with ice) which is directed on to the hands of the workman. There is no doubt that it is this which brings on the attacks of spasm. The rate of vibration does not seem to be of great importance, but there is some evidence that the amplitude of the machine may play a part in determining the onset of this syndrome.

Small areas of decalcification of the bones of the carpus appear to be a later stage and were described by Brailsford (1934: "The Radiology of Bones and Joints," p. 27, London). Another change is apparent periosteal overgrowth on volar surfaces of shafts of phalanges. This sometimes occurs, however, in normal man (Kohler, A., 1931: "Roentgenology," p. 17, London).

Seyring describes three groups of quite distinct illness or

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injury which are incontestably related to the occupation of using a pneumatic drill:⁴ (a) disturbances in bloodvessels; (b) affections of the muscles; and (c) injuries to joints.

Actual injuries of joints were first described by Holzmänn in 1929.⁵ They have generally occurred in miners, hewers, metal workers and riveters. In eight out of ten of his cases the right elbow was involved, the symptoms being pain and limitation of movements, especially extension. In one case detachment of a piece of bone occurred, and this had to be removed by operation. The duration of employment had been three years in one case, and in others six to ten years. The changes were described under such varying terms as "arthritis deformans," "myositis ossificans," "osteo-chondritis dissecans," "chondro-dermatitis," etc. It was largely on the basis of this report that the condition was included amongst diseases and injuries scheduled under the German Workmen's Compensation Act, 1929, in the following terms: "Disease of muscles, bones and joints from the use of pneumatic drills." Vasomotor disturbances are not included in this definition.

I have been privileged through the courtesy of the Home Office and also of Dr. McLaren⁶ to examine two series of X-rays of men who had been using pneumatic tools for varying periods. I have also found several cases attending hospital. No evidence was found of changes of any sort under two years. It appeared, moreover, as would be expected from the way in which most workers grasp the machine, that where changes could be seen in the wrist they most often affected the radial side, the commonest lesion in my experience being a slight increase ("spiking") in the angles of the trapezium bone. This, however, appears to be symptomless, but when marked is sometimes reported as being an early osteo-arthritic change. The cysts mentioned above were not infrequently observed in these series.

Middleton⁷ found localisation to vary, but, although the radial side was more often affected, the thumbs never suffered. X-rays seen appeared to show changes slightly more frequently on the radial side, suggesting that trauma from the employment was a factor in their production.

Moulouquet-Doleris showed some X-ray films of the elbows of workers with pneumatic tools at the Second Annual Meeting of the French League against Rheumatism in 1931 which demonstrated changes in these joints, and similar changes have also

been described subsequently by Mauclaire and Minet⁸ and Sommer,⁹ whilst Sigand and Terray¹⁰ described a case in 1932 of occupational arthritis of the left wrist in a right-handed miner which they thought was due to the use of a pneumatic drill. This was, they stated, the first lesion of this nature to be reported. Junghanns¹¹ reported a similar case at considerable length in 1937, and illustrated his paper with an excellent X-ray showing "pseudo-arthritis" of the navicular bone. Other cases have been reported by Hardgrove and Barker.¹²

W. C. Meiss¹³ examined X-rays of 107 workers in Holland who had used pneumatic drills for one to twenty-five years. In twenty-four of these articular changes were recorded: osteophytic changes at head of radius and at the first carpo-metacarpal joint; also myositis ossificans on the anterior surface of the humerus at the origin of the brachialis anticus and at the insertion of the same muscle and of the triceps. Lesions were mostly limited to the right side in right-handed people, but in one case of a left-handed worker all these changes were on the left side. There was very little disability clinically. As a control series Meiss examined radiographically 100 workmen of various other occupations between the ages of forty-eight and sixty-five and found no osseous changes of this nature.

In 1934 F. W. A. Weber¹⁴ described a case of a sixty-five-year-old man who had worked as a steel cleaner for fourteen years who developed ulnar nerve paralysis and muscle wasting and who was found radiographically to have a severe osteo-arthritis of the right elbow-joint. P. Rostock¹⁵ in the same year mentioned a miner who showed arthritic changes in his right elbow after working with pneumatic drills for nine years. He was re-examined five and a half years later while still at work, and these changes were then found to be gross. Another worker who showed changes after four and a half years was taken off work three months after the examination, and one and a half years later the changes were found not to have progressed. He suggested that the cause of progression in such cases was primarily the detachment of small pieces of joint cartilage as the result of vibration.

In the same issue of this journal F. Linow described four cases of injury resulting from the use of pneumatic tools for stone crushing. One was in the shoulder and two in the elbow and one necrosis of the lunate bone.

A similar case of degeneration of the carpus produced by use of a compressed-air drill was reported in 1937 by A. R. Jones.¹⁵ His patient had used a jackhammer, a powerful drill which is held in both hands and which if not properly held may "kick back." The patient received such a kick in 1927 and was off duty for four days. An X-ray ten years later shows such crushing of the semilunar bone that all typical features were lost. The os magnum showed an old fracture and contained a large cyst. There were also degenerative cavities at the lower end of the radius. The author was unable to state whether this condition was due entirely to the injury or also in part to the cumulative effects of using the drill, since there was no history of any other injury to the hand.

Rostock suggests¹⁶ that the joint injury produced depends upon the way the particular joint reacts to vibration. In joints of the hand, he says, there is always produced a condition of osteo-chondritis dissecans, especially of the lunate, or a "pseudo-arthritis" of the navicular bone. At the elbow this osteo-chondritis ("subchondrial necrosis") also develops, and is caused by the bone surfaces being pressed together. Since there is in addition prolonged tension of the musculature, an abnormal strain is put on to the points of muscle attachment, and periosteal proliferation also develops (especially in brachialis internus), which may also affect the joints. Thick bone proliferation in the form of "olecranon spurs" is of this nature. Less often the shoulder-joints are affected, and where this occurs the condition is one of ordinary traumatic osteo-arthritis. These conditions, although they may be found in other classes of workers, are, according to him, ten times more common in miners using pneumatic drills than any other. True joint changes, however, occurred in only 0.08 per cent. of the miners in his series of 833 joint injuries alleged to have occurred in men who had worked with pneumatic tools for a long period. He mentions that between 1929 and 1933 there were only 336 cases who received compensation under the Act for occupational joint injuries of this sort in all Germany.

A further type of joint injury caused by these tools was reported by Moulouguet¹⁷ in 1931, but not apparently since. He described the formation of foreign bodies in the right elbow-joints of two quarrymen who had complained of stiffness and pain. There was no previous rheumatic history. One of them, aged

forty, had used the tool for three years, whilst the other, aged forty-five, had worked in this way for ten years. Figs. 1 and 2 are tracings of the original X-ray in the latter case.

My own contribution is the discovery in a roadman, aged forty-eight, of a calcified subacromial bursa in conjunction with early degenerative changes around the shoulder-joint. He had used the drill for a period of only four years, but had noticed gradually increasing stiffness and pain in the shoulder which he attributed to his work (Fig. 2). At the time of seeing him the

FIG. 1.

FIG. 2.

pain had become very acute, and he was unable to follow his employment. It seemed certain that this condition was intimately connected with the use of the pneumatic drill. I am unable, however, to find any record of another case of this type.

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