days. This period was decreased if doses of 25 to 50 mg. were given (Birnberg, Kurzrok, and Klor, 1940). Siegler and Silverstein (1940) inhibited lactation by giving total doses of 25 to 125 mg. of testosterone dipropionate in divided doses every 12 hours, with a total of three to five injections. Lass (1942) states that methyl testosterone in repeated doses of 25 mg. inhibits lactation in 48 hours; total dosage was from 250 to 350 mg. In 7 out of 25 cases methyl testosterone was effective on the first day.

A new synthetic oestrogen—octofollin or 2:4-di-(*p*-hydroxyphenyl)-3-ethyl hexane—has recently been used for the inhibition of lactation (Murphy, 1943). This, given over a period of four days in doses of 5 m.g. t.i.d., yields results similar to those obtained with stilboestrol.

From this discussion it is clear that hexoestrol dipropionate given parenterally is more effective for the inhibition of lactation than the other synthetic oestrogens and testosterone or its derivatives. With the possible exception of methyl testosterone none of these is effective in inhibiting lactation on the first day of treatment. The use of synthetic androgens in high dosage is ruled out on the grounds of expense.

Summary

A single intramuscular injection of 12.5 mg. of hexoestrol dipropionate inhibited lactation in 66% of a series of 44 mothers shortly after childbirth. When given within the first three days of delivery lactation did not occur, and there were no signs of breast engorgement or discomfort. Of the remaining 34% all but 2% ultimately responded to repeated injections. Only 18% required treatment for more than three days.

A further course of injections, given to suppress "secondary filling," was necessary in only 7% of the cases. This compares well with the figure of 25 to 45% for stilboestrol.

Hexoestrol dipropionate, given intramuscularly in one or two doses, was effective in suppressing lactation in five cases in which it had already been established.

Hexoestrol dipropionate given by mouth is not so satisfactory as when given by injection.

Literature on the inhibition of lactation by oestrogens and androgens is reviewed.

Thanks are due to the members of the resident medical staff of the Mothers' Hospital, Clapton, for their assistance and care in keeping records of the cases.

REFERENCES

- Abarbanel, A. R., and Goodfriend, M. J. (1940). *Amer. J. Obstet. Gynec.*, **40**, 1037.
 — and Klein, M. D. (1941). *N.Y. St. J. Med.*, **41**, 383.
 Barnes, J. (1942). *British Medical Journal*, **1**, 601.
 Birnberg, C. H., Kurzrok, L., and Klor, S. J. (1940). *Amer. J. Obstet. Gynec.*, **39**, 107.
 Bishop, P. M. F., et al. (1940). *Lancet*, **1**, 629.
 Bloom, O. H. (1941). *Amer. J. Surg.*, **54**, 443.
 Campbell, N. R., et al. (1939). *Lancet*, **2**, 312.
 Connally, H. F., et al. (1940). *Amer. J. Obstet. Gynec.*, **40**, 445.
 Davis, M. E., and Boynton, M. W. (1941). *J. clin. Endocrinol.*, **1**, 339.
 Duffy, P. V., and Corsaro, J. (1941). *J. Amer. med. Ass.*, **116**, 33.
 Folley, S. J. (1936). *Biochem. J.*, **30**, 2262.
 — and Kon, S. K. (1936). *Proc. roy. Soc. B*, **124**, 476.
 Haultain, W. F. T. (1942). *Edinb. med. J.*, **49**, 73.
 Kurzrok, R., and O'Connell, C. P. (1938). *Endocrinology*, **23**, 476.
 Kushner, J. I. (1942). *J. clin. Endocrinol.*, **2**, 345.
 Lass, P. M. (1942). *Amer. J. Obstet. Gynec.*, **43**, 86.
 Macpherson, A. I. S., and Robertson, E. M. (1939). *Lancet*, **2**, 1362.
 Mendel, E. B., Goldman, A. M., and Caire, A. (1941). *Amer. J. Obstet. Gynec.*, **42**, 528.
 Miescher, K., Scholz, C., and Tschopp, E. (1938). *Biochem. J.*, **32**, 141, 725.
 Muckle, C. W. (1940). *Amer. J. Obstet. Gynec.*, **40**, 133.
 Murphy, J. A. (1943). *Ibid.*, **46**, 146.
 Nelson, W. O. (1936). *Physiol. Rev.*, **16**, 488.
 Palmer, A., Martin, P. L., and Fulton, L. (1942). *Clinics*, **1**, 750.
 Selye, H. (1934). *Amer. J. Physiol.*, **107**, 535.
 Siegler, S. L., and Silverstein, L. M. (1940). *Amer. J. Obstet. Gynec.*, **39**, 109.
 Stewart, H. L., and Pratt, J. P. (1941). *Ibid.*, **41**, 555.

The 208th session of the Royal Medical Society of Edinburgh will open on Friday, Oct. 13, with an inaugural address by Lord Moran, P.R.C.P., on "The Anatomy of Courage." Other addresses will be given on Oct. 27, by Sir Joseph Barcroft, on "Problems in Foetal Life"; on Nov. 10, by Sir Alexander Fleming, on "Penicillin"; on Nov. 24, by Prof. J. H. Gaddum, on "The Discovery of New Remedies"; on Jan. 12, by Sir John Boyd Orr, on "The Future of Medicine"; on Jan. 26, by Lieut.-Gen. Sir Alexander Hood, on "The Army Medical Services in Peace and War"; on Feb. 2, by the Right Hon. Walter Elliot, on "Medicine and the State"; and on Feb. 16, by Col. J. C. Kimbrough, U.S. Army Medical Corps, on "Wounds of the Genito-urinary Tract in Modern Warfare."

FACTORS INFLUENCING DERMATITIS IN COAL-MINERS

BY

R. B. KNOWLES, M.D.

Many of the dermatoses to which miners are subject may occur in any person, whatever his trade, but some are directly or indirectly associated with the conditions under which these men work. The latter forms may be divided into two main groups: (I) those due, in the main, to trauma and infection, which might be called "the stigmata of miners"; (II) cases of dermatitis in the usually accepted sense, including occupational dermatitis.

Group I

The blue-black scar present on the skins of most miners is due to the fine particles of coal-dust which enter a wound at the time of injury. Callosities on the hands are common, and are to be seen across the heads of the metacarpals and on the inner side of the thumb, where the tools set up constant friction. The boots cause thickenings of the skin on the front and back of the ankle.

Bursae, true and false, play a part in the infections and injuries to which coal-miners are liable. False bursae may occur along the heads of the metacarpals, producing, when infected, the "beat-hand" of the miner. Bursae at the patella and olecranon may become the "beat-knee" and the "beat-elbow." Foreign bodies between the knee-pads and the skin sometimes help in the production of "beat-knee."

These infections are not likely to occur without some abrasion of the skin, which allows the entry of bacteria and provides a medium suitable for their growth. Various kinds of pyoderma may thus be produced either by staphylococci (boils, pustules, folliculitis, subcutaneous abscesses, and ulcers) or by streptococci (vesicles, bullae, impetigo, ecthyma, with lymphangitis and cellulitis, onychia, and whitlow). "Infected abrasions" are a very common condition among miners. Acid burns on the buttock, caused by the leakage of sulphuric acid from the lamp-battery, are also seen.

Group II

Clinically, acute cases are often eczematous, and chronic cases, as a result of constant irritation and scratching, may become lichenified. Starting with erythema, the dermatitis may become vesicular, weeping, scaly, papular, pustular, and follicular. Occasionally there is fissuring of the palm. The chief symptoms are itching, soreness, and pain.

Most of these cases of dermatitis involve chiefly the hands and forearms, the feet and legs; but some begin on the trunk and others attack the trunk after starting elsewhere. Sometimes an intertrigo occurs in the axillae or groins, or between the toes. Encouraged by moisture, heat, and friction, streptococci produce this intertrigo of the skin; or it may be due to a monilial infection and occur in the gluteal folds. In coal-miners, intertrigo may also be found on the outside of the forearm and the inner part of the thigh, as the result of constant friction of the arm against the thigh when using pick and shovel.

An eczematous eruption in the external auditory meatus may be caused by particles of stone and coal falling into the ear which is uppermost when a collier is in the reclining position.

There are few miners who do not wear a belt, and friction between this and the skin may determine the onset of a dermatitis around the lower abdomen. Fungous infection of the feet has recently become prevalent, and its spread appears to be facilitated by pit-head baths. It is more common in the summer months, and occurs in three principal types: (a) Sudden white skin between and underneath the toes, especially in the fourth interdigital cleft. The infection may spread and produce pustules on the soles of the feet. (b) Superficial scaling of parts of the hands or feet. (c) An eruption of deeply set vesicles on the soles of the feet: this is the most common type. The infection may also spread to the groins, to produce tinea cruris; the axillae, perineum, natal cleft, and thighs may be involved.

Improper treatment of wounds or skin lesions—e.g., by sulphur ointment, iodine, or antiseptics—may produce dermatitis.

Cleansing agents which are used to remove dirt and dust may be irritant to the skins of some miners, and a dermatitis may ensue; excessive use of soap may be the cause. Oil employed on coal-cutting and boring machines may set up a dermatitis, or paraffin used to remove oil may act similarly. Prolonged or repeated contact with oil may produce oil acne. Creosote dermatitis has been found among coal-miners from handling creosoted props: the hands, wrists, face, and neck are affected with a pustular eczema.

During the last few months I have visited nine pits in order to obtain information about the factors involved in the causation of dermatitis in coal-miners. The conclusions reached are the result of personal observations and discussions with colliery officials and workmen, of experience in general practice in a mining community, and of attending the skin department of the Chesterfield and North Derbyshire Royal Hospital.

These pits employ 7,700 men, and the number of cases of dermatitis certified over a period of two years was 56, a percentage of 0.70—the incidence in the separate pits varying from 0 to 1.8%. The accompanying table gives various details of

Table showing Details of 9 Pits, including Incidence of Dermatitis

Pit	Depth (yards)	Month	Dry-bulb Temp. (° F.)	Wet-bulb Temp. (° F.)	Relative Humidity	% Dermatitis in 2 Years	Height of Coal Face	No. of Men Employed	Distance Coal Face from Shaft (miles)	Pit-head Baths	Fungus Infection of Feet Reported
A	158	Dec.	60	58	88	0.6	5' 0"	300	1	No	No
B	365	..	70	69	94	0.8	3' 3"	700	1	Yes	No
C	330	..	63	60	82	0.3	4' 0"	1,600	1	Yes	No
D	170	..	50	49	93	0.17	3' 3"	600	1	No	No
E	170	Jan.	58	57	93	0.2	3' 3"	500	2	No	No
F	720	..	81	71	56	1.8	4' 3"	1,300	2	Yes	No
G	700	May	71	62	59	0	4' 6"	650	1	Yes	Yes
H	640	..	62	57	72	0.83	3' 6"	1,200	1	Yes	Yes
I	800	..	74	70	79	0.11	4' 6"	850	2	Yes	No

the pits visited. The hygrometer readings are those in the return airway after the air has circulated along the coal face.

The pits vary in depth and in working conditions. D and E are very wet; the others are on the whole dry pits, water being found only in certain districts in C and H. F is a hot deep pit, and the coal face is two miles from the shaft. All except three have pit-head baths, and the incidence of dermatitis in these three is not high. An outstanding point is that in F the incidence of dermatitis is more than twice as high as that in any of the other pits: it is significant that it is the hottest pit.

Aetiology

The chief factors influencing the nature and cause of dermatitis in coal-miners are:

1. *Factors due to Pit Conditions.*—(a) The ventilation of the pit: temperature; humidity; height of coal face; distance of coal face from shaft. (b) The presence of water and the substances dissolved in it. (c) The quantity, quality, and state of subdivision of dusts and the effect of machinery on these.

2. *Factors due to the Mental and Physical Constitution of the Workmen.*—(a) Behaviour in relation to trauma and infection. (b) The presence of skin conditions—seborrhoea, hyperidrosis, ichthyosis—which may predispose to dermatitis.

3. *Friction between skin surfaces or between clothes and the skin.*

4. *The use and abuse of cleansing agents and popular skin applications in general.*

Pit Conditions

Ventilation.—Of paramount importance is the ventilation of the pit: on this depend the temperature and the amount of sweating. Dermatitis appears to be more common in deep hot pits, where sweating is profuse and the air current does not evaporate the sweat from the body.

Humidity.—The factor next in importance is the humidity of the atmosphere. The amount of sweating depends to some extent on this, for, at a given temperature, the higher the relative humidity of the atmosphere the less will be the evaporation of sweat. A man's capacity for work is greatly impaired when

the wet-bulb temperature exceeds 82° F., and even at a wet-bulb temperature of 72° F. inconvenience is felt unless only light clothing is worn. It may be possible to do a fair amount of work at wet-bulb temperatures above 82° F. if air at a good velocity is kept blowing over the exposed surface of the miner, but the limit is 85° F. It seems that the dry-bulb temperature is of secondary importance, as a case is recorded in which the man—working devoid of clothing—experienced little inconvenience in a temperature of 95.5° F. dry-bulb and 74° F. wet-bulb (Penman and Penman, 1927).

Height and Distance of Coal Face.—Two other factors are the height of the coal face and the roof in general, and the distance of the coal face from the shaft. A shallow coal face makes the working conditions more difficult; walking in a pit the roof of which is low produces more sweating and increases the amount of friction on the body surface. The temperature at the coal face depends to some extent on the distance of the latter from the shaft.

Presence of Water.—Pit-water, and mineral salts and organic matter dissolved in it, play a part in the production of some cases of dermatitis. Pits D and E are very wet, but have a low incidence of dermatitis and a high one of fibrositis and myositis; in these pits the men are exposed to water under foot and from the roof. But the pits are shallow, and the water is mainly from the surface and has not percolated through much depth of soil and rock. On the other hand, water in a deep pit has a higher concentration of salts and seems to be more irritant. In pit H men had more irritation and smarting of the skin when working in a wet part.

Dusts.—Dust is produced in large quantities in coal-mines—probably more so since the introduction of machinery. Limestone dust is also strewn in the roadways. In the mines, dust collects on the face, trunk, hands, knees, ankles, and between the toes. Friction between skin surfaces or between clothes and the skin rubs dust in: it is not usual for dermatitis in miners to begin on the trunk above the line of the belt. More often it begins on the hands and forearms, or legs and feet, and particularly at the boot-top level; or, if on the trunk, in the region where the trousers or shorts are held in contact with the skin. In these places there is friction. During the exit from the pit all these factors—sweating, dust, and friction—are in operation. The quantity of dust can be reduced by having a fine spray of water operating where dust is produced in large quantities (coal-cutting machines, borers, and at the loader-end).

The Constitutional Factor

Since the majority of coal-miners are not prone to occupational dermatitis, some other causal factor must be inherent in the sufferers themselves. Intelligence, behaviour, general health, and the texture and natural qualities of the skin may determine whether a dermatitis occurs, and, if it does, may modify the type of dermatitis produced. Men with thick, dark, oily skins are, as a rule, less susceptible than those with fair, thin, dry skins. Those with relatively hairless skins are less liable to folliculitis from oils and grease than those with hairy arms and legs. Ichthyosis predisposes to dermatitis. A seborrhoeic skin is greatly affected by sweating, and seborrhoeic dermatitis is not uncommon among miners. Hyperidrosis may be a potent factor in the causation of dermatitis.

In other cases dermatitis is caused by cleansing agents, or applications of ointments or antiseptics to some existing skin lesion.

Conclusion

Dermatitis in coal-miners, then, is not due to any single cause; it is the summation-effect of many factors, some of which are provided by the conditions of work and others by the constitutional make-up of the men. The prophylaxis of dermatitis in coal-miners depends on avoiding the causes, so far as is possible. The chief points in prophylaxis are:

1. Adequate ventilation of the pit is essential.
2. The quantity of dust must be reduced to a minimum.
3. Water, if possible, ought to be pumped away.
4. Education of the miner by:

(a) Notices posted at the pit telling him to report any suspected dermatitis at its onset; (b) instruction of ambulance attendants on how to treat such cases—e.g., application of protective lotion;

(c) warnings of the possible effects of unsuitable cleansing agents and home remedies (good soaps, vegetable oils, and liquid paraffin allowed); (d) emphasis on the advantages of cleanliness.

5. Selection of suitable personnel for work in the pit.

6. Application of protective substances to the skin.

7. Warnings of the increased risks of working when ill or insufficiently recovered from illness.

8. Prevention of fungus infection of the feet—a difficult matter: (a) New workers should be examined before they are admitted to the baths. (b) To prevent contact between the feet and the bath floors, slippers should be worn and sterilization of these be periodically carried out. (c) Infected men should have separate baths.

My thanks are due to the University of Sheffield for permission to publish this article, which is an abstract of a thesis; to the managements of the collieries I visited; and to Dr. Rupert Hallam, dermatologist to the Chesterfield and North Derbyshire Royal Hospital, for his helpful suggestions.

REFERENCE

Penman, D., and Penman, J. S. (1927). *A Treatise on Mine Ventilation*, p. 86. London.

INTRAVENOUS ANAESTHESIA

CONTINUOUS POSITIVE-PRESSURE DRIP SALINE WITH INTERMITTENT PENTOTHAL

BY

W. M. MAIDLOW, M.R.C.S., D.A.

Major, R.A.M.C.

Many articles have recently appeared on pentothal anaesthesia with drip-feed continuous saline, and each of the various methods has its advantages and disadvantages.

Criticisms of Previously Described Methods

Drs. Roberts and Sellick (1944) have answered Mr. O'Connor (1944) satisfactorily, by stressing the fact that the metal stand used in the gravity technique is both cumbersome and often in the way of the surgeon or assistant. A further disadvantage of this method is seen when the operating table has to be moved during the operation—as, for example, during a meniscectomy, when the surgeon, having been operating with the leg bent over the end of the table and the light shining over his shoulder into the joint, starts to sew up with the leg straight and the light directly overhead. This entails moving the whole table some distance, so that the drip has to be moved also. Care has to be taken not to dislodge the needle or connexions as the tubing sways, the container has to be steadied in case it becomes unhooked or is broken, and at the same time the anaesthetic machine, if in use, has to be moved also.

Dr. Griffin (1944) overcomes this difficulty to a certain extent by affixing the drip-container to a bar on the Boyle's table model. This type of machine is, however, by no means universal, and I for one would hesitate to make such an alteration to a McKesson machine or to my own portable apparatus.

Mr. O'Connor had criticized the apparatus described by Drs. Roberts and Sellick (1943) by suggesting that leakage of blood may occur back from the vein during intervals of injection or if the pressure in the saline bottle should drop. Drs. Roberts and Sellick counter this criticism by saying that a clip can be fixed distal to the bellows to prevent leakage of blood back. They point out that the ideal method is to use a flow of oxygen to produce the necessary pressure. Besides being wasteful, I cannot quite see why a minor explosion does not occur in the saline bottle when the tubing is pinched to admit the pentothal, unless the oxygen supply is turned off during this procedure, thus adding an extra manipulation. This could, of course, be avoided by fitting an automatic mercury manometer or blow-off valve; but this only adds further complications and, to my mind, disadvantages. It is my intention to describe a simple method that will obviate these difficulties, still employing the bellows method of producing pressure for the drip.

Having used the gravity method for a considerable time, I decided to try the positive-pressure method, when I was

confronted with the difficulty of having no stand on which to hang my saline reservoir, and by the fact that I had been anaesthetizing for a fairly large series of meniscectomies (sometimes 6 in a morning) and becoming more and more tired of lugging a heavy metal stand to different positions. Also people in the theatre frequently tripped over the metal base. I had a mental picture of the surgeon one day stepping back and losing both his balance and his dignity.

There are a number of disadvantages in using the technique described by Drs. Roberts and Sellick.

1. Constant pricking of the tubing raises the question of sterilizing the puncture site at every injection, with consequent delay at a time when the patient requires a further dose immediately.

2. The need to pinch the tubing to avoid backwash, thereby possibly obscuring the drip chamber, means that the anaesthetist's hand is taken from the patient's jaw and his attention from the general condition.

3. Towels that may be in the vicinity of the operation have to be touched, and are perhaps disarranged, which may interfere with the surgeon or assistant.

4. The question where to place the syringe during intervals between injecting and the question of the sterility of the needle.

5. The eventual destruction of the rubber tubing (it is better to have thin-walled tubing, as it is lighter on the needle), with consequent leakage, which seems to occur most often at the start of a new case, thus not setting out with a 100% efficient system.

The aspiration indicator described by Drs. Roberts and Sellick is a most useful adjunct after induction of the patient in his bed or on a stretcher; with it we can be quite sure the needle is in the vein when making the puncture on the operating table. I have, however, made it a rule to avoid all extra glass tubes, indicators, adapters, and wire bindings which perish the tubing, so as to minimize leakages from the system.

Regarding Dr. J. L. Griffin's method, the main disadvantages seem to be:

1. The apparatus is cumbersome to sterilize.

2. The risk of breakage opens up the question of expense and possibly difficulty in replacing the containers immediately.

3. The length of tubing necessary.

4. The U-tube method, with two containers and one drip chamber, makes it difficult to estimate the exact dose that is required immediately. There must be some delay while the saline in the tube distal to the drip is run through, and the surgeon does not wait before exciting any strong stimulus, which may not have been adequately anticipated. Again, the patient, having been placed at a required depth, will proceed to become a certain degree deeper when the saline is readmitted, from the pentothal still remaining in the tubing. This allows an error to occur in the estimation of dosage. I note, however, that Dr. Griffin uses $2\frac{1}{2}\%$ solution and analeptics, and tubing of very narrow bore; but the margin of error still remains, and can be entirely overcome by the method described below.

An Effective and Simple Method

To overcome the above disadvantages I now use a three-way tap, which is situated close to a needle of medium length to facilitate removal of the syringe. One hand turns the tap, which is easily found even if covered with towels, and the same hand injects the pentothal, which is therefore admitted almost at the site of venepuncture, thus entirely overcoming all question of dead space. At the same time the flow of saline automatically ceases, and there can be no backwash or leakage up any tubes. The third arm of the tap runs to a reserve supply of pentothal in a gallipot slung in a ring on a metal stand. This stand is clamped to the arm-rest or a table, if the leg is being used, and consists of an upright metal bar about 6 in. high, on top of which is a platform holding the metal clip from the box in which all Record syringes are supplied. The 20-cm. syringe rests in this, and is quite secure and out of the surgeon's way. The syringe here comes easily to the hand of the anaesthetist, who remains seated at the head. About 6 in. of narrow-bore thin-walled tubing runs from an adapter on the syringe to one arm of the three-way tap. Another arm carries the tubing from the drip bulb and bottle; a metal sinker holds the tubing in the reserve pentothal supply.

There is one slight theoretical disadvantage when using the positive-pressure technique—namely, on turning the tap to inject pentothal the drip saline continues unless the clip proximal