It should perhaps be explained that many of the " gaps " were due to interruption of immunization during a polio season.

Injection–Disease Time Lapse.—The lapse of time between the date of last whooping-cough injection and the development of whooping-cough was 1.7 years in the doubtful group and 1.6 years in the confirmed group. Actually the shortest time lapse in these cases was four months and the longest 35 months.

Age at First Injection.—The average age of the affected children at their first injection was 3.7 months in both the confirmed and the doubtful group, whereas the average age for the whole group was 3.9 months.

Blood Results.—Only 10 of the 33 children who developed whooping-cough had been bled at the age of 15 months and had had their pertussis agglutination titres measured. These varied from 1/20 to 1/1,280, from which it may be concluded that agglutination titre is no reliable index of protection against whooping-cough. This agrees with the findings of Horton and Standfast (1953).

Home Contacts.—In our follow-up questioning the parents of 35 infants reported that their child had been a home-contact with another suffering from whooping-cough; none of these 35 developed the disease. Unfortunately we have no information on the home-contact rate in respect of the 22 almost certain cases and 11 doubtful ones, although, of course, as they developed the disease they must have been in contact somewhere with an infected child.

Notification Rate.—Of the 22 definite cases, only 5 were notified in our area. Another 7 may have been notified out of the area, but this still leaves 10 definite cases not notified in their own area. One should be wary, therefore, of accepting notification incidence as a reliable measure of whooping-cough prevalence.

Summary

Two groups of infants were inoculated against diphtheria and pertussis in early infancy. One group received three doses of whooping-cough vaccine at monthly intervals, followed by two doses of P.T.A.P. The other group received three doses of combined formol-toxoid and whooping-cough vaccine. In the subsequent three years no significant difference was found in the frequency of undoubted whooping-cough in the two groups. Since, however, 22 children did develop the disease some 19 months after the end of primary immunization, a booster dose at the age of 15–18 months seems to be recommended. As whooping-cough is a more serious disease in very young babies, it might be thought advisable to give the first injection at 2 months or even younger in view of the fact that those immunized at 2 months appeared to be as well protected as those whose first injections were given at 3, 4, or 5 months.

Thanks must be accorded to Dr. G. Stewart, County Medical Officer, Essex, and to Dr. F. Groarke, Area Medical Officer, Barking, for permission to carry out the work. We gratefully acknowledge the assistance of colleagues, especially the invaluable help of Mr. Brian in the collection of blood samples, and of Mrs. Pratt, the nurse who assisted at these sessions. Thanks are also due to Mrs. Tidbury and Miss Valerie Harper for many hours of cheerful and willing clerical assistance.

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Medical Memoranda

Ehlers-Danlos Syndrome with Congenital Herniae and Pigeon Breast

The Ehlers–Danlos syndrome, described by Ehlers in 1900 and by Danlos in 1908, is rare. The classical features are: (1) hyperelasticity of skin; (2) friability of the skin and the blood vessels, with a tendency for wounds to gape and a susceptibility to intracutaneous or subcutaneous haemorrhages, even from trivial trauma, or occasionally to visceral haemorrhages; (3) profuse scarring, usually papyraceous in type; (4) hyperextensibility of joints; (5) frequent presence of tiny mobile subcutaneous nodules, probably of a lipomatous nature; and (6) familial incidence of one or more of the above features.

CASE REPORT

A 3-year-old French Canadian boy was admitted to Ottawa General Hospital on July 6, 1957, because of a lacerated injury over the right knee. Even minor injuries were apt to cause skin cuts, lacerations, bruises, and bumps, and he had numerous scars over his body. Since birth his skin had been very soft and elastic. He was born prematurely and had congenital umbilical and inguinal herniae. The umbilical hernia was repaired. At the age of 1 year he received multiple lacerated injuries in a car accident; the wounds gaped after the removal of only two stitches on the fifth day. His father's skin was soft, doughy, and slightly hyperelastic; his palms and soles were soft, his fingers could be slightly overextended, and his feet were flat. He had no scars or friability of skin. No abnormalities were found in other members of the family.

On physical examination the boy, though mentally alert, was seen to be somewhat underdeveloped, being 2 ft. 10 in. (86 cm.) in height, and weighing 27 lb. (12.2 kg.). His head circumference was 20 in. (51 cm.) and the fontanelles were closed. He could stand and walk normally. He had a pigeon breast (Fig. 1), and there were numerous scars all over his body, mostly on the face, head, left arm, knees, legs, and feet. Some of the scars appeared to be due to stitched or unstitched wounds. A few scars were papery, particularly over the lower abdomen and the forearms. There were a few bruises. A fresh lacerated gaping wound was seen across the front of the right knee.

The skin was doughy, soft, velvety, and elastic, and could be easily stretched for about 1 to 2½ in (2.5 to 6.4 cm.) over the arms, forearms (Fig. 2), thighs, and legs. When let go the skin immediately returned to its position, like a piece of soft rubber, leaving no wrinkles or folds. No subcutaneous nodules were palpable. The mucus membrane was not elastic.

The child had large bilateral, reducible, indirect inguinal herniae, and the scar of the repaired umbilical hernia was visible.

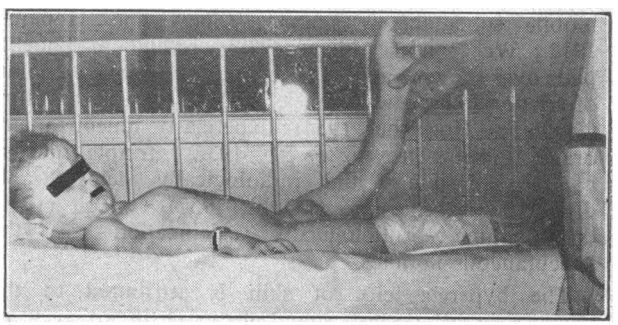

FIG. 1.—Hyperextensible knee and pigeon breast.

The limbs were hypotonic. The fingers (Fig. 3) and toes could be easily overextended by 180 degrees or twisted without any discomfort or pain. The knees (Fig. 1), elbows, wrists, and ankles could also be overextended. Abnormal lateral movements were possible at the knees. Both feet were flat.

Urinalysis, leucocyte, erythrocyte, and platelet counts, bleeding and clotting times, and haemoglobin were normal. Rumpel-Leede sign was negative.

FIG. 2 FIG. 3

FIG. 2.—Hyperelastic skin of the forearm. FIG. 3.—Extremely hyperextensible fingers.

Skin Biopsy.—Skin obtained from above the patient's right knee was compared with a few control sections of skin obtained at necropsies from patients of about the same age and nutritional state. Histological examination showed an increase in the amount of elastic tissue and a considerable deficiency of collagenous connective tissue of the corium. The epidermis was wrinkled.

COMMENT

This case illustrates the chief features of Ehlers-Danlos syndrome. Two associated defects, which apparently have not been previously reported, were pigeon breast and congenital umbilical and inguinal herniae. The skin biopsy showed the usual picture described as typical of this syndrome.

The elasticity of the skin in these cases is sometimes remarkable. Murray and Tyars (1940) reported a case where it was possible to pull the skin from the sternal region to cover the mouth. The wounds to which the skin is very prone usually leave papyraceous scars which may be very profuse. The joints are lax and hyperextensible. The fingers and toes may show double-jointedness. The joint instability can cause subluxations, dislocations, sprains, and a tendency to fall on walking which may lead to repeated fractures, as observed by Johnson and Falls (1949).

Many other abnormalities have been reported in association with this syndrome, including lenticular opacities (Johnson and Falls, 1949); molluscoid and raisin-like tumours (Ronchese, 1936); hard, freely mobile subcutaneous nodules (Shaw and Hopkins, 1912; Weber and Aitken, 1938); redundant knuckle pads over the toes and tumour-like formations at points of friction (Ross and Dooneief, 1957); pectus excavatum (Smith and Hornisher, 1954); hyperelastic mucous membrane (Gilbert-Dreyfus *et al.*, 1936); friable mucosa of sigmoid colon and radiologically demonstrable diverticula of intestine (Jacobs, 1957). Holt (1946) demonstrated radiologically calcification of the subcutaneous nodules.

The hyperelasticity of skin is attributed to the increase in elastic tissue and decrease in collagen of corium. The blood vessels, although very friable, are usually unremarkable on histological examination.

The cause of this syndrome is not understood. Some relate it to possible endocrine imbalance, neurofibromatosis, abnormalities of calcium or carbohydrate metabolism, and often prematurity. The syndrome is often familial and is inherited as an incomplete dominant. Coe and Silvers (1940) reported affection of four generations. Johnson and Falls (1949), in a comprehensive study, reported a family pedigree covering six generations, with 21 men and 11 women affected.

It has been suggested by Benjamin and Weiner (1943) and others that some disturbance in the embryonic mesenchyme may be responsible for the anomalies of the skin, which is of ectodermal origin, and of the capsules and ligaments of the joints, which are of mesodermal origin. A further study of the internal organs and, wherever possible, necropsy examination might reveal evidence of mesenchymal dysplasia in other organs such as dissecting aneurysm of the aorta and other blood vessels and congenital anomalies of the urinary tract as have been reported with Marfan's syndrome. Congenital lenticular defects, also associated with Marfan's syndrome, have been reported in cases of Ehlers-Danlos syndrome.

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Vaccination against yellow fever, which is necessary for those intending to visit a number of Central and South American and mid-African countries, is likely to be made more easily obtainable. Up to the present such vaccination has only been available at Regional Blood Transfusion Centres and certain hospital laboratories with special storage facilities and knowledge of necessary laboratory technique. Now that the vaccine is prepared in dried form and may be stored in an ordinary domestic refrigerator, local health authorities have been asked by the Ministry of Health to offer yellow fever vaccination to those requiring it. The number of centres where it can be obtained will thus be increased if the local authorities are willing to provide the service (Ministry of Health, No. 10, June 6).