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BOILS AND ALLERGY.

by

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PART ONE. GENERAL CONSIDERATION OF BOILS.

"Les deux infections staphylococcique et streptococcique sont le centre et le giron de la bacteriologie cutanee." (Sabouraud, R.)

INTRODUCTION :

Boils are considered as a minor ailment and they are usually treated by general practitioners. Dermatologists and other specialists are consulted only if any complications arise from boils.

The discovery of sulphonamides, Penicillin and other antibiotics was a great help in combating this common complaint. Appearance of resistant strains of staphylococci to antibiotics has removed the umbrella of safety offered at first by these antibiotics.

The present study of boils was carried out in general practice. The writer has noticed that most of the patients suffering from boils were also suffering from allergic diseases, and he decided to investigate them closely. The patients were examined in the surgery, and the laboratory tests were carried out in the Pathological Laboratory to which every practitioner in this area has a free access.

THE PATHOLOGY OF BOILS :

The boil or a furuncle is an acute circumscribed infection of a hair follicle caused by staphylococcus pyogenes. A boil can develop on any part of the body. The site of a boil is determined by the presence of pilosebaceous follicles. The pilosebaceous follicle penetrates the superficial layer of the cutis and it serves as a portal

of entry for the staphylococcus pyogenes. Palms, soles and lips are devoid of such follicles, and the occurrence of boils in these places is rare.

The first evidence of a boil is the appearance of a localised induration and reddening of the skin. After a few days the inflammation ends in the production of pus which escapes by rupture of the top of the boil. There remains a necrotic mass, or the core, inside the boil which gradually separates and is ejected. A cicatrix is formed which may leave a permanent mark on the skin.

In some patients there may be a succession of boils constituting a state known as furunculosis (Sabouraud, 1900; Allbutt and Rolleston, 1911; Whitwell and Sutherland, 1950; Ormsby and Montgomery, 1954).

BACTERIOLOGY OF BOILS :

Colcott Fox (1911) gives a historical account of initial researches concerning staphylococcal infections. Sabouraud (1900) emphasized the importance of staphylococci in furunculosis.

Staphylococcus is a gram positive organism. Colonies of staphylococci grown in a culture produce a pigment. Staphylococci can be divided into three groups, according to the colour of the pigment they produce. Staphylococcus aureus produces a golden pigment; staphylococcus albus a white, and staphylococcus citreus a yellow pigment. Staphylococcus aureus is usually isolated from most boils, but staphylococcus albus may be also pathogenic.

Staphylococcus citreus is usually a commensal (Fairbrother, 1953). Elek (1959) considers *staphylococcus pyogenes* the most appropriate term for the pathogenic *staphylococcus aureus*.

AETIOLOGY OF BOILS :

Diabetes mellitus :

It is generally believed that diabetes mellitus predisposes a patient to boils (Anning, 1953; Ormsby and Montgomery, 1954). Tauber (1933) studied 137 diabetic patients. He found only 18 cases among them suffering from boils and carbuncles. He also made estimations of blood sugar in 1,500 persons. There were 257 cases of furunculosis, pyoderma and ecthyma in this group. He found normal blood sugar levels in the patients suffering from the above skin conditions. Elek (1959) thinks that the presence of Keto acids in diabetes protects staphylococci within polymorphs from the bactericidal action of lactic acid. He states also that in diabetes there is a depression of general immunity and a poor response to anti-body formation.

DIET : (1) Carbohydrates, (2) Proteins, (3) Vitamins.

Carbohydrates :

Excessive carbohydrates intake is often blamed for recurrent boils (Urbach, 1946; Anning, 1953). According to Urbach (1946) high carbohydrate intake promotes cutaneous hydration, and this leads to easy infection. Rothman (1954) states that high carbohydrate intake increases the activity of sebaceous glands and it predisposes the skin to infection.

Proteins :

With protein deficiency there is a drop in resistance to infections. This lowering of resistance has been related to inadequate formation of antibodies (Cannon et al, 1943; Rothman, 1954). Malnutrition during the famines and wars, grave general diseases and fevers are said to be responsible for boils (Urbach, 1946; Anning, 1953; Ormsby and Montgomery, 1954).

Vitamins :

The effects of vitamins on the skin have been discussed by Sinclair (1956). Vitamins are essential for maintaining healthy integrity of the skin (Rothman, 1954; Harris and Mumford, 1955). Sinclair (1956) emphasizes also the importance of essential fatty acids in the physiology of skin.

INDIGESTION AND CONSTIPATION :

Some patients suffering from boils take laxatives believing that they can get rid themselves of boils by taking laxatives. The ill-effects of constipation are not proved and they are probably of psychogenic nature (Harris and Mumford, 1955). Urbach (1946) believes that indigestion due to anacidity or hyperacidity is responsible for the production of abnormal compounds in the alimentary tract. These abnormal products after absorption may act as irritants on the cutaneous sensory nerves, rendering the skin more susceptible to inflammation.

ALCOHOL :

The adverse effect of alcohol on the skin is discussed by Harris and Mumford (1955). They believe that alcohol causes dilatation of blood vessels in the skin and it increases perspiration. Increased perspiration alters the pH of the skin, and the skin is susceptible to infection.

DRUGS :

Dermatologic manifestations of drug reactions are discussed by Alexander (1955). Ormsby and Montgomery (1954) mention that drugs, and especially iodides, if taken as tonics may bring on furunculosis. McDermont (1956) and Dubos (1956) drew the attention to antibiotics, antihistamines, anticoagulants and steroid hormones as predisposing factors to staphylococcal infections.

EPIDEMIOLOGY OF BOILS :

The sources of infection :

It has been estimated by various workers that from 5% to 60% of healthy population are skin carriers of staphylococci, and that from 30% to 50% are the nasal carriers (Hansel, 1953; Cruinkshank, 1953; Miles, 1954; Loewenthal, 1954; Brodie et al, 1956; Shooter et al, 1957). Throat carriers of staphylococci are less than 1% (Miles, 1944). It has been pointed out by Miles (1944) that a silent infection of finger, nasal vestibule etc., may be a dangerous source of staphylococci. Anning (1953) states that there is a great increase

of staphylococci around a boil and also all over the body at the time of boil formation. This increase persists for a few weeks after the lesion is healed. He drew attention to soiled dressings and clothes as sources of staphylococci. Loewenthal (1954) performed counts of bacterial flora from eczematous lesions. Heavy growth of staphylococcus pyogenes was obtained from such lesions, especially from weeping places.

Transmission of staphylococci :

It appears that the spreading factor of staphylococci are hands. There are many people who handle their noses frequently and contaminate their hands with staphylococci present in the external nares (Miles, 1944; Anning, 1953; Shooter et al, 1957).

Variants of staphylococci :

Most of the bacteria undergo dissociation or variation. Bacterial dissociation consists of the appearance of organisms in pure culture, which differ from the parent strain. R (rough), S (smooth) and G (mucid) forms of staphylococci have been described. Cross-agglutination and cross-complement fixation were found for all these forms. It has been noticed that the change of S to R forms brings on a change in the original virulence. Dissociated forms are not virulent and do not cause lesions. Only the original strain is virulent. The dissociated forms are only a part of the normal cycle of changes through which the organism passes (Hoffstadt and Youmans, 1932).

STAPHYLOCOCCAL TOXINS :

Haemolysins :

It was observed by the earlier workers (Kraus and Clairmont, 1900;

Neisser and Wechsberg, 1901) that pathogenic staphylococci produce haemolysins of rabbits red blood cells in vitro. Four staphylococcal haemolysins have been observed ; alpha, beta, gamma and delta. They can be differentiated by their properties to haemolyze the red blood cells of various animals (Rogers, 1956; Boyd, 1956). Haemolysins are considered as an important factor in the pathogenicity of staphylococci. The most frequent pattern among human pathogens are the alpha and delta lysins. All human strains produce one or other type of haemolysins, while coagulase negative strains can be distinguished by lack of haemolysins (Lack, 1956; Elek, 1959).

Coagulase :

Most of the pathogenic strains of staphylococci produce a substance which has the power of clotting blood plasma. Contrary to physiological coagulation, the coagulase acts in the presence of citrate and oxalate ions and heparin. Coagulase is antigenic for the rabbit and monkey, but its antigenicity for man has not been established. It has been suggested that coagulase delays phagocytosis of staphylococci by its ability to initiate the deposition of fibrin. The action of coagulase is transient, but it saves the organism from phagocytosis during the initial phase, enabling it to multiply and produce toxins (Fairbrother, 1953; Boyd, 1956; Lack, 1956; Tager, 1956; Elek, 1959).

Hyaluronidase :

This enzyme is produced by many different organisms including pathogenic staphylococci. It depolymerises the hyaluronic acid in the connective tissue and it aids establishing the local infection

(Boyd, 1956; Lack, 1956). Hyaluronidase is identified now as "the spreading factor" described by earlier workers (Duran-Reynolds, 1933; McClean and Hale, 1941). Hyaluronidase production runs parallel with high yields of coagulase, alpha lysin and many other properties. Of the coagulase-positive strains 93.6% produce hyaluronidase, while none of the coagulase-negative strains produce the enzyme (Elek, 1959).

Leucocidin :

This substance is found in the filtrates of pathogenic staphylococci and it destroys the leucocytes (Neisser and Wechsberg, 1901; Fairbrother, 1953; Rogers, 1956). The antigenicity of leucocidin is established and specific antibodies have been demonstrated (Elek, 1959).

Enterotoxin :

Staphylococcal enterotoxin is recognised as the most common cause of food poisoning. It is a thermostatic substance. The exact chemical nature of enterotoxin is not known because of the lack of adequate assay procedure (Fairbrother, 1953; Boyd, 1956; Bergdoll, 1956).

Fibrolysin :

Nearly all pathogenic staphylococci produce this enzyme, and the majority of coagulase positive human strains are fibrinolytic (Boyd, 1956; Lack, 1956; Elek, 1959).

Dermonecrotxin :

The significance of this toxin has been discussed by Dworetzky et al. (1956) and Elek (1959).

Staphylophages :

Bacteriophages comprise a group of viruses parasitic upon bacteria. It is possible to divide the strains into groups according to the differential action of the phages. It was found that strains isolated from related sources reacted to the same phages and could be differentiated from other cultures by this method. It was shown that strains obtained from the nose and hands of carriers are generally identical, and that in familial outbreaks affecting different members of the same family, the same strain may be involved (Cruinkshank, 1953; Elek, 1959).

SOME CONSIDERATIONS OF THE DEFENCE MECHANISM OF THE SKIN :

The skin surface varies according to the size of a person, but generally it accounts for 16% of the total body weight. The skin is subjected to constant insults, physical, chemical and bacterial, and it deals effectively with these insults. The literature concerning the defence mechanism of the skin is very large, and the writer studied some of it which was related to his present work.

The sweat and the pH of the sweat :

The vast number of sweat glands distributed all over the skin produce sweat which is mainly concerned in the regulation of body temperature. A mixture of sweat, sebum and other secretions of the sebaceous glands constitutes an acid mantle which was described by Schade and Marchionini (1928). The reaction of freshly secreted sweat is acid with the average pH of 5.75 (Rothman, 1954). Harris and Mumford (1955)

suggest that the bactericidal properties of the skin are possibly due to direct action of pH on the organism, or else that the acid mantle favours the development of certain protective factors. It is possible that certain skin ferments might provide such protective factors. The pH of the skin can be affected by diet, drugs, diseases of the skin and skin contactants such as oil.

Diet :

Alkalinizing diet can shift the pH of the skin to the basic side, while a fasting diet produces an acidifying effect. Vegetarian diet reduces the reactivity of the skin to stimuli, while carbohydrate diet increases the reactivity to inflammatory stimuli (Urbach, 1946). High carbohydrate diet causes water retention in the skin and it facilitates lactic acid formation which changes the pH of the skin (Harris and Mumford, 1955).

Drugs :

Alkalis taken in large doses may alter the pH of the skin. Certain drugs produce skin eruptions. These eruptions may be a pharmacologic response like iodism, or they may represent an allergic manifestation like sulphonamide rashes (Alexander, 1955).

The skin diseases :

In eczema and dermatitis the pH of the skin shifts towards the alkaline side and the pH of fluids of most skin blisters is around 7 or higher. This alkaline shift in acute eczema is attributed to exudation of serous fluid. The pH values on the top of inflammatory

papules and scaling lesions do not exceed 6.

In chronic, lichenified and scaling eczemas normal values or little alteration is noticed (Loewenthal, 1954; Rothman, 1954).

Anatomical distribution of sweat and the pH values:

The pH of the skin varies in different parts of the body. The diminished acidity of the skin can be found in the axillae and between the toes. These places have in common an impaired evaporation of the sweat. The sweat stagnates and acidification is diminished through low concentration of fatty acids (Hermann et al, 1946; Rothman, 1954).

Effects of soap, detergents, solvents and other chemicals on the pH of the skin :

The buffering capacity of the skin has been discussed by Loewenthal (1954) and Rothman (1954). It appears that persons whose skin is sluggish in neutralising acids and alkalis are predisposed to various eczemas. In such patients there is a slow return of normal pH of the skin after contact with acids or alkalis. The detrimental effect of detergents, solvents, oils and polishes have been recognised by dermatologists and industrial doctors (H.M. Stationery Office, form 296, 1932; Loewenthal, 1954; Martin-Scott and Ramsay, 1956).

PART TWO. INVESTIGATION OF BOILS IN GENERAL PRACTICE.

"The clinical evidence of inborn immunities from, and liabilities to infective maladies is very strong, and is convincing to the family medical attendant who watches his patients and their families over a period of years" (Garrod, E.).

SELECTION OF PATIENTS :

Patients suffering from boils and carbuncles were included in this investigation. Patients suffering from styes, otitis externa, whitlows, infected wounds, abscesses or discharging sinuses were excluded. The author is one of three partners who practice together. Patients treated already for boils by the two other partners, and who came as follow up cases, were not included in this investigation. Only patients who came to the author with boils as a fresh complaint. were investigated. Altogether 60 patients were investigated from 15.5.1956 till 22.8.1957. After twelve months it was difficult to find new cases and most of the patients coming with boils were the patients already investigated.

TESTS :

The following tests were carried out before any treatment was given.

SWAB FROM THE LESION :

This was obtained by expressing some of the pus from the lesion and soaking a swab in it.

SWAB FROM THE NOSE :

A swab was moistened in an ampoule of sterile water and both

nostrils were cleaned with it. The moistening of the swab was necessary to obtain more material from the nose.

BLOOD COUNT :

Blood was obtained by puncture of vein and placed in an oxalate container.

INVESTIGATIONS REQUESTED :

Both swabs and the samples of blood were investigated in the Pathological Laboratory in Barrow-in-Furness. Direct films were taken from the swab and cultures were made.

It was difficult to collect a specimen of blood from small children, and from apprehensive patients, and therefore 12 cases had no blood examination carried out. The examination of blood included red blood cells, white blood cells counts, haemoglobin estimation and differential count.

THE pH OF THE SKIN :

This test was carried out with the universal indicator paper (E. Merck, A. G. Darmstadt). A strip of the paper held in forceps was moistened in distilled water and placed firmly against the skin in the afflicted area, close to the boil. A similar test was carried out on a healthy skin area. Change of colour occurred within a few seconds, and this was compared with the colour chart.

SKIN TESTS TO STAPHYLOCOCCUS PYOGENES PRODUCTS :

Staphylococcus pyogenes intradermal solution (Bencard Ltd.) was used. A Mantoux syringe was employed. A small amount (0.02 c.c.)

of the solution was injected intradermally on the inner aspect of the forearm. A similar amount of intradermal control solution was injected below the first one. The weal and erythema resulting from the injections were drawn on a transparent paper and reproduced on the back of the patient's history chart. The skin reactions were measured with a transparent skin testing reaction gauge (Bencard Ltd.).

RESULTS OF INVESTIGATIONS :

History taking was considered very important and each patient was questioned very carefully.

SEX DISTRIBUTION :

There were 42 male patients (70%) and 18 female patients (30%).

COMMENT : Male patients seem to suffer from boils more often than female patients.

AGE DISTRIBUTION :

Five patients (8.3%) were between the age of 1 - 10 years. Three patients (5%) were between 10 - 15 years. Seven patients (11.6%) were between 15 - 20 years. Sixteen patients (26.6%) were between 20 - 30 years and 29 patients (48.3%) were over 30 years of age.

COMMENT : Children under 15 years of age rarely suffer from boils. The majority of patients in this series were over 30 years of age.

OCCUPATION :

There were 13 general labourers (21.6%), twelve housewives (20%), six schoolchildren (10%), three clerks, three retired persons, one factory foreman, one shopkeeper, one gardener, three machinists, three joiners, one ward maid, three mechanics, one farm labourer, one child under five years of age, one plasterer-decorator, one electrician, one welder, two shop assistants, one engine driver, one chemist at Glaxo Penicillin Factory.

COMMENT : No special occupational group is pre-disposed to boils.

DURATION OF SYMPTOMS :

Fourteen patients (23.3%) had symptoms of boils for three days before they came for medical help. Thirteen patients (21.6%) suffered four days, eight patients (14.0%) suffered five days and 24 patients (40.0%) had boils for over five days before they came to the Surgery.

COMMENT : It appears that it takes three days or more for a patient with a boil to seek medical help. A large proportion of patients (40.0%) came to the Surgery after five days from the onset of boils. It is possible that many patients try to cure their boils by home remedies.

LOCATION OF LESION :

Fifty one patients had a single boil and nine patients suffered from multiple boils in different parts of the body.

The single lesion was distributed as follows :

Back of the neck	11	patients
Forearm	7	"
Face	5	"
Forehead	4	"
Ankle region	4	"
Dorsum of the hands	3	"
Dorsum of the fingers	3	"
Temple	2	"
Wrists	2	"
Shoulder blade region	2	"
Axilla	1	"
Elbow region	1	"
Dorsum of the foot	1	"
Thigh	1	"
Groin	1	"
Abdominal wall	1	"
Sacral region	1	"
Corner of the mouth	1	"
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Total	51	"
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Multiple boils were distributed as follows :

Neck and both forearms	3	"
Neck and face	2	"
Neck, wrist and legs	1	"
Forehead and knee	1	"
Both legs	1	"
Both forearms	1	"
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Total	9	"
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COMMENT : Unclothed areas of the skin are more often affected by boils than the covered areas. The back of the neck, face, forehead, corners of the mouth and temples are the common places for boils.

SEASONAL INCIDENCE :

The first case of boils was investigated on 25/5/1956 and the last on 22/8/1957.

May, 1956	3 patients
June	6 "
July	3 "
August	8 "
September	6 "
October	6 "
November	3 "
December	3 "
January, 1957	1 "
February	4 "
March	5 "
April	3 "
May	2 "
June	3 "
July	1 "
August	3 "

COMMENT : There is a peak incidence of boils during the months of August, September and October. This observation confirms the findings of Whitwell and Sutherland (1950).

HISTORY OF PREVIOUS SKIN INFECTIONS :

There were 48 patients (80.0%) who have had boils before. Three patients remembered suffering from impetigo and one patient suffered from athlete's feet.

COMMENT : The majority of patients (80.0%) suffered from boils before.

HISTORY OF TRAUMA :

There were ten patients who blamed insect bites for their boils, and twelve patients admitted having itchy skin and scratching.

COMMENT : Abrasions, lacerations and other wounds complicated by infection were not included in this study.

HISTORY OF CONTACT :

Five patients observed that their friends at work had boils and there were six patients whose family members were suffering from boils.

COMMENT : From this observation it appears that boils are not highly infectious, or else that the majority of people at large are immune to staphylococcus pyogenes.

PSYCHOLOGICAL FACTORS :

Four patients were suffering from anxiety states and one from menopausal symptoms.

COMMENT : This finding does not support the theory that nervous strain predisposes patients to boils.

RELATION OF BOILS OCCURRENCE TO PERIODS IN WOMEN :

Exacerbation of acne vulgaris does occur during the periods in women. No relation of boils to the menstrual periods in women was observed in this study.

GENERAL HYGIENE :

The author has been in general practice for the past six years and he had opportunity to visit the homes of all the patients under investigation.

HOUSE CONDITIONS :

Patients homes were assessed as follows : There were 28 very clean houses (46.6%), eleven clean houses (18.3%), twelve neglected houses (20.0%) and nine dirty houses (16.6%).

HOW MANY PEOPLE AT HOME :

The average house in Barrow-in-Furness consists of two bedrooms, one sitting room and a kitchen/dining room. There were thirteen patients (21.6%) coming from a 2-person house, 18 patients (30.0%) from a 3-person house, 17 patients (28.0%) from a 4-person house and 12 patients (20.0%) from a house where there were more than 4 persons living.

BEDROOM ACCOMMODATION :

There were 42 patients who shared a bedroom with another person, 13 patients who had a bedroom to themselves, 3 patients shared a bedroom with another 2 persons, and 2 patients slept with more than 2 other persons in the same bedroom.

PRESENCE OF BATHROOM :

There was no bathroom in 19 houses.

BATHING :

Barrow-in-Furness is an industrial town with an old district (Old Barrow) where there are no bathrooms in the houses. The majority of the population live in new Council houses, with bathrooms. There are the Public Baths with an indoor swimming pool where many people attend. It was found that 30 patients (50%) took a bath twice a week, 18 patients (30%) once a week, and 12 patients (20%) took a bath occasionally.

WASHING THE HANDS :

There were 11 patients (18.3%) who washed their hands twice a day, 14 patients (23.3%) who washed their hands three times a day,

and 35 patients (58.3%) who washed their hands more than three times a day.

WASHING THE FACE :

There were 54 patients (90%) who washed their faces twice a day, 2 patients washed their face only once a day, and 4 patients three times a day.

THE KIND OF SOAP :

Light toilet soaps (Lux, Palmolive, Knight's Castille, Caddum) were used by 50 patients (83.3%) for washing their hands and face, Carbolic soaps were preferred by 10 patients. No powder soaps were used for washing the hands and face.

ANTISEPTICS AND DETERGENTS :

One patient was using Dettol for cleaning the hands, and 6 patients used Stergene occasionally for washing the hands.

DRESS NEXT TO SKIN :

There were 50 patients (83.3%) wearing cotton vests or shirts next to the skin. Six patients (10%) wore woollen vests, and 4 patients preferred silk vests.

COMMENT : There is no evidence that patients suffering from boils live in overcrowded or dirty houses. Only 9 houses were considered as dirty houses by present day standards, and only 7 patients were found to be sharing a bedroom with more than one person. Most of the patients kept themselves clean by adequate washing of their hands and

faces, and only 12 patients admitted not having a regular bath. Antiseptics, detergents, and carbolic soaps were used by a few patients. The majority of patients used high quality soaps which could not have a deleterious effect on the skin. The author had a chance to wash his hands in some of the patients' houses, and he was able to confirm the kinds of soap being used. There were only 3 patients who washed their nasal vestibules with soap and water routinely. It is difficult to determine the importance of such a routine washing of the nasal vestibules in patients suffering from recurrent boils without a further study of this subject. There were 6 patients wearing woollen vests at the time of examination and, therefore, overheating of the body and excessive sweating due to wearing warm clothing can be excluded in the majority of patients.

EATING HABITS :

There were 41 patients (68.3%) who enjoyed mixed food and who had no preference for any particular item of food. Starchy food was preferred by 16 patients (27%) and meat by 2 patients.

Fruit was eaten every day by 20 patients (30%), twice a week by 2 patients, once a week by 3 patients, and only occasionally by 35 patients (58.3%).

Alcohol was taken at the weekends by 12 patients (20%) and 48 patients (80%) did not take alcohol at all.

TAKING MEDICINES :

Three patients were taking halibut oil capsules, three insulin, 2 alkalis, 1 thyroid extract, 1 antihistamines, 2 anti-spasmodics, 2 iron preparations, 1 dexamphetamine sulphate, 1 chlorpromazine, 1 Mycardol and 2 laxatives.

SKIN PREPARATIONS :

Three patients were using Ung.Calam. Co., 2 Ung. Hydrocortisone, and 1 Lassar's Paste.

BOWEL HABITS :

Three patients admitted suffering from constipation, and one had loose stools.

COMMENT : There is no evidence from this study that the eating of starchy foods predisposes patients to boils. The majority of patients (68.3%) had no preference for any particular kind of food. There were 16 patients (27%) who liked eating starchy food. The fruit intake by the patients under investigation was low. Twenty patients (30%) ate fruit every day. Some patients considered fruit too expensive to buy, and others not as a necessity. The majority of patients (80%) did not take alcohol at all. There were 3 diabetic patients who had daily injections of insulin, but the boils in these patients were not found at the site of the injections. There were no drugs or tonics taken which could predispose patients to boils, except perhaps alkalis. Five patients were using

skin preparations for eczematous lesions. Only 3 patients suffered from constipation and 2 of them admitted taking laxatives regularly. There is no evidence that patients suffering from boils suffer also from constipation.

PATIENTS OWN IDEAS :

Ten patients (16.6%) considered insects bites as a cause of boils, and 10 patients blamed the dirt at work. Seven patients said that they were feeling "run-down" and that is why they developed boils. Four patients blamed the itch and scratching of the skin. Two patients thought they had "got a germ" from their friends who had boils. Two blamed the summer heat and excessive sweating. One blamed excessive periods, 1 shingles, 1 sunburn and 1 friction of the collar stand.

COMMENT : The history of insect bites in the aetiology of boils deserves a further consideration, and this will be taken up in the discussion.

PHYSICAL EXAMINATION :

Every patient was examined before any treatment was given. The examination included : cardiovascular system, respiratory system (with special attention to the nose and throat), taking the blood pressure, central nervous system, abdomen, urine, skin for texture, amount of sweat and any focus of infection, scalp, nails, weight and height. The teeth were also inspected.

THE WEIGHT :

Patients were weighed on the scales, and their height measured. Their weight and height were compared with the standard charts. Twelve patients (20%) were above average weight and seven below average. No gross obesity or debility were observed.

EXISTING DISEASES (OTHER THAN ALLERGIC) :

Diabetes mellitus	3	patients	
A febrile cold	3	"	
Duodenal ulcer	2	"	
Osteo-arthritis of hips	2	"	
Recent miscarriage	1	"	
Chronic otorrhoea	1	"	
Herpes zoster of face	1	"	
Recent coronary thrombosis	1	"	
Myxoedema	1	"	
Meniere's Disease	1	"	
Hyperhidrosis	1	"	
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	17	"	(28.3%)
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URINE TESTS :

Urine was tested for sugar and albumin. Benedict's solution was used for the sugar tests. There were three known cases of diabetes mellitus whose urine gave positive tests to Benedict's re-agent. No fresh cases of diabetes were discovered through urine tests in patients suffering from boils.

TEXTURE OF SKIN AND THE AMOUNT OF SWEAT :

Examination of the skin revealed greasy skin in 10 patients (16.6%) and dry skin in 5 patients. Some patients were working in hot places at the factories and 21 patients (35%) admitted that they sweated excessively at work.

THE SCALP :

Dandruff was found in 9 patients (15%). Four of the patients with dandruff had boils on the neck and face, and the other 5 patients had boils elsewhere.

THE NAILS :

Nails were inspected for cleanness, evidence of nail biting or paronychia. It was found that 21 patients (35%) had dirty nails and 2 patients were biting their nails. No chronic paronychia was observed. Some patients came to the surgery direct from work, and had no time to wash their hands.

THE TEETH :

There were 7 patients with septic teeth, and 1 with pyorrhoea. There were 20 patients (33.3%) who had dentures.

FOCUS OF INFECTION :

There were 24 patients (40%) who had a boil or septic cracks in the nostrils. Two patients had angular stomatitis, 2 had signs of recently healed boils, 3 suffered from follicular acne, and 1 had sycosis barbae.

COMMENT : General examination of the patients suffering from boils did not reveal any gross debility, malnutrition, deficiency diseases, or personal neglect and dirty habits. The incidence of foci of staphylococcal infection among these patients was high.

INCIDENCE OF ALLERGIC DISEASES :

Personal history of allergic diseases	53 patients	(88.3%)
One allergic complaint	29 "	(48.3%)
Two allergic complaints	19 "	(31.6%)
Three allergic complaints	5 "	(8.3%)
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Total	53 "	
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There were 7 patients without personal history of allergic disease. Among them were 2 non-allergic diabetic patients and 2 patients gave a history of allergic disease in the family. There were 3 patients without diabetes, and personal or family history of allergy.

NATURE OF ALLERGIC DISEASE :

Nasal allergy (allergic rhinitis of hay fever)	22 patients
Bronchial asthma	8 "
Contact dermatitis	4 "
Atopic eczema	9 "
Urticaria	9 "
Dermatitis medicamentosa	1 "
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Total	53 "
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COMMENT : Allergic disease can run concurrently. Usually one manifests itself clinically and the others are latent or in subclinical state causing no symptoms. In the present study it was decided to take into consideration this allergic illness which was causing most symptoms to the patient at the time of examination.

FAMILY HISTORY OF ALLERGIC DISEASE :

Bronchial asthma	23 patients	
Allergic skin diseases	12 "	
Nasal allergy	7 "	
	—	
	42 "	(70%)
	—	

COMMENT : The personal and family history of allergic disease among the patients suffering from boils is very high.

THE RESULTS OF THE TESTS :

Table No. 1. The pH of the afflicted skin area.

<u>pH</u>	<u>Number of patients</u>	<u>% of patients</u>
5	14	23.3%
5.5	9	15%
6	31	51%
6.5	2	3%
7	4	6.6%

Table No. 2. The pH of the healthy skin area.

<u>pH</u>	<u>Number of patients</u>	<u>% of patients</u>
5	8	13.3%
5.5	9	15%
6	33	55%
6.5	3	5%
7	7	11.6%

COMMENT : The majority of patients suffering from boils have the pH of the sweat in the afflicted and healthy skin areas within normal limits.

Table No. 3. Skin reactions to staphylococcus pyogenes products.

<u>Diameter of reaction in mm.</u>	<u>Number of patients</u>	<u>% of patients</u>
8	1	
10	1	
12	6	
14	21	35%
16	13	20.6%
20	16	26.6%
25	1	
30	1	

Table No. 4. Skin reactions to control solution.

<u>Diameter of reaction in mm.</u>	<u>Number of patients</u>	<u>% of patients</u>
1	1	
2	5	8.3%
3	4	6.6%
4	2	
5	5	8.3%
6	7	11.6%
7	5	8.3%
8	7	11.6%
9	8	13.3%
10	5	8.3%
12	6	10%
14	4	6%
16	1	

COMMENT : There were 58 patients (96.6%) whose skin reactions to staphylococcus pyogenes products varied from 12 mm. to 20 mm. in diameter. There were no skin reactions below 8 mm. in diameter. All the control reactions, except one,

were between 1 mm. to 14 mm. in diameter. Only one patient gave a skin reaction to control injection 16 mm. in diameter. Patients suffering from boils give strong cutaneous reactions to staphylococcus pyogenes products.

EXAMINATION OF THE PUS FROM THE LESIONS :

Staphylococcus pyogenes was isolated from boils in 58 patients (96.6%). Staphylococcus albus was isolated from boils in the remaining 2 cases.

Table No. 5. Organisms recovered from the nose.

<u>Nature of organisms</u>	<u>Number of patients</u>	<u>% of patients</u>
Staphylococcus pyogenes	47	78%
Staphylococcus albus	4	6.8%
Diphtheroids	4	6.8%
Streptococci	1	
Bacillus proteus	1	
No growth	3	

COMMENT : The presence of staphylococcus pyogenes in 58 cases of boils, and staphylococcus albus in the remaining 2 cases confirms the general observation that boils are caused by staphylococcal infection. Staphylococcus pyogenes was recovered from the nostrils of 47 patients and staphylococcus albus from 4 patients.

BLOOD EXAMINATION :

Blood was not examined in 12 patients, but on physical examination there was no evidence of anaemia among them.

HAEMOGLOBIN :

Among the 48 patients whose blood was examined there were 3 patients who had Hb. levels between 70% and 80%. These 3 patients were considered as slightly anaemic.

THE WHITE BLOOD COUNT :

W.B.C. up to 6,000 per c/mm.	13 patients
W.B.C. between 6,000 and 10,000 per c/mm.	25 "
W.B.C. over 10,000 per c/mm.	10 "

Total	48 "

EOSINOPHILS COUNT :

There were 5 patients whose eosinophils count was between 5% and 10%. There were 3 patients with eosinophil count over 10%.

COMMENT : No gross anaemia was discovered among the patients suffering from boils, by routine blood examination. There were 35 patients who had a moderate leucocytosis denoting acute infection in their bodies. The eosinophils in the blood stream fluctuate and eosinophil counts in allergic patients have no relation to the severity of allergic symptoms (Hansel, 1953).

PART THREE. CONTROL STUDIES OF BOILS.

"The first stage of most discoveries is the chance observation, which in not a few instances has been associated with the false assumption" (Sir Henry Cohen).

METHODS :

One hundred allergic patients attending the Allergy Clinic, North Lonsdale Hospital, Barrow-in-Furness, were investigated for history of boils. Nasal swabs taken from these patients were investigated in the Pathological Laboratory for organisms.

One hundred non-allergic patients were investigated in general practice for history of boils. Nasal swabs were also examined for organisms. Great care was taken to make it absolutely certain that these patients neither suffered from allergic diseases, nor came from allergic families. This last point was considered important to exclude any latent allergic complaint. The investigations were carried out concurrently during the 1959 year to avoid seasonal differences.

RESULTS.THE ALLERGIC PATIENTS :SEX AND AGE :

Fifty male and fifty female patients were investigated. Their ages varied from 15 to 75 years. No children under 15 years of age were taken into control group.

ALLERGIC DISEASES :

There were 69 patients suffering from bronchial asthma; 19 patients suffered from nasal allergy (hay fever/allergic rhinitis); 8 patients complained of eczema - dermatitis, and 4 patients suffered from urticaria.

HISTORY OF BOILS :

There were 65 patients who had boils in the past. There were 43 male and 22 female patients who had the boils. Among those 65 patients there were 21 cases who had also boils at the time of examination.

NASAL CARRIERS OF STAPHYLOCOCCUS PYOGENES AND OTHER ORGANISMS :

Staphylococcus pyogenes was isolated in 71 patients, 36 male and 35 female patients.

Staphylococcus albus was recovered from the nasal vestibules in 24 patients; streptococcus haemolyticus in 3 cases; diphtheroids in 1 case. No growth was observed in one case.

THE NON-ALLERGIC PATIENTS :

SEX AND AGE :

Fifty male and fifty female patients were investigated for history of boils. Their ages varied from 15 to 75 years and no children under 15 years of age were included in this group.

THE DISEASES OF THE NON-ALLERGIC PATIENTS :

Patients attending every day surgeries were investigated. Their complaints covered most of the common diseases met in general

practice : industrial injuries, peptic ulcer, iron deficiency anaemia, rheumatic diseases, varicose veins, thyrotoxicosis, ischaemic heart disease, epilepsy, lumbago-sciatica syndrome and others.

HISTORY OF BOILS :

In the 100 of non-allergic patients 15 patients remembered having boils in the past. There were 11 men and 4 female patients who had the boils. Among them only one case of iron deficiency anaemia had a boil at the time of examination.

NASAL CARRIERS OF STAPHYLOCOCCUS PYOGENES AND OTHER ORGANISMS :

There were 45 patients who were nasal carriers of staphylococcus pyogenes.

Staphylococcus albus was recovered from 31 cases; bacillus proteus in 7 cases; streptococcus haemolyticus in 4 cases; neisseria catarrhalis, bacillus subtilis, bacillus Friedlander and coliform bacillus in one case respectively. No growth was observed in 7 cases.

PART FOUR. DISCUSSION.

"The essential nature of that state of the organism which gives a proclivity to disease, and permits external agents to act upon the animal body, so as to produce morbid conditions, may never be fully known to us."
(Blackley, G. H.).

Two main findings emerge from this work, (1) that boils occur more frequently in allergic patients than in non-allergic ones and (2) that nasal carriers of staphylococcus pyogenes are found more frequently in allergic than in non-allergic patients.

That the incidence of boils is significantly higher in allergic patients than in the non-allergic patients is shown below.

COMPLAINT OF BOILS OVER A PERIOD OF 15 MONTHS :

5,350 non-allergic practice patients	-	7 cases of boils
250 allergic practice patients	-	53 cases of boils

HISTORY OF BOILS IN CONTROL GROUPS :

100 non-allergic patients in practice	-	15 cases of boils
100 allergic patients from the Allergy Clinic	-	65 cases of boils

It has been shown in part two of this work that there were no serious epidemics, no debilitating diseases, no malnutrition, no overcrowding and no lack of hygiene in the patients suffering from boils. It is evident from this work that there exists a close relationship between the allergic diseases and boils and this will be discussed now.

NASAL ALLERGY :

Allergic patients, whatever their main allergic disease may be, suffer frequently from allergic rhinitis or hayfever. There were 22 patients (36.6%) in the sixty cases of boils who complained of allergic rhinitis or hay fever at the time of examination.

Pathogenic bacteria, including staphylococcus pyogenes are inhaled with the air, or transferred on the fingers to the nasal vestibule. They penetrate the congested mucous membranes without much resistance and bring on infections of paranasal sinuses or boils in the nasal vestibule. Hansel (1953) discussed the various factors which facilitate the infection of sinuses and nasal mucosa in patients suffering from nasal allergy. He pointed out that normal maxillary sinuses do not contain bacteria and if any bacteria are inhaled, they are quickly eliminated. In allergic rhinitis there is a change of pH of the nasal secretion from acid to alkaline, the lysozyme is diluted. The congestion of mucous membranes brings on stagnation of secretions and the ciliary activity is impaired. All these factors according to Hansel (1953) favour the infection of nasal mucosa and sinuses.

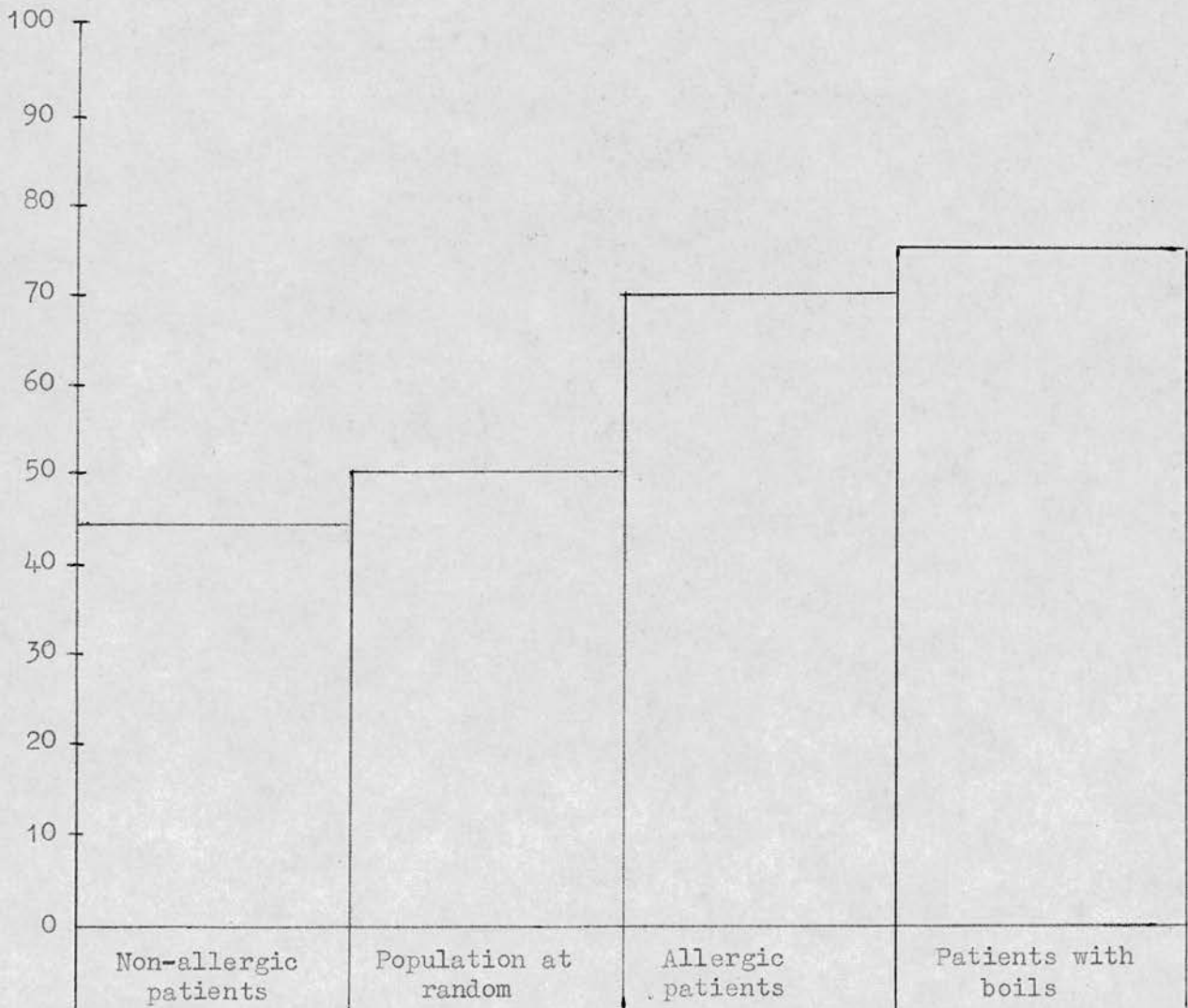
The skin around the nostrils of patients suffering from allergic rhinitis is often cracked and infected. There were 24 patients (40%) in the group of 60 cases of boils who had a focus of staphylococcal infection in the nose. Stevens (1953) and Hansel (1953) observed that patients suffering from nasal allergy often complain of purulent nasal discharge, especially after a cold. The most common bacteria cultured from nasopharynx are the staphylococcus pyogenes, streptococcus

viridans and neisseria catarrhalis.

It was estimated by various workers, as shown in part one of this study, that from 30% to 50% of the population are nasal carriers of staphylococcus pyogenes.

In the 60 cases of boils 47 patients (78%) were nasal carriers of staphylococcus pyogenes. In the 100 allergic patients 71 patients (71%) were nasal carriers of staphylococcus pyogenes. In the 100 non-allergic patients 45 patients (45%) were nasal carriers of staphylococcus pyogenes. These findings are presented graphically.

TABLE NO. 6. NASAL CARRIERS OF STAPHYLOCOCCUS PYOGENES.



It appears, therefore, that allergic diseases predispose the patients to be nasal carriers of staphylococcus pyogenes.

ALLERGIC SKIN DISEASES :

Loewenthal (1954) showed by contact cultures that heavy growth of staphylococcus pyogenes can be obtained from eczematous lesions. According to him staphylococcus pyogenes can be recovered from 0 to 62% in healthy skins and from 58% to 100% in eczematous skins.

Allergic skin diseases are associated with itching or burning sensation at the site of the lesion. There were 23 patients (38%) in the 60 cases of boils complaining of allergic skin diseases. The itchy skin in such patients is subjected to touching, rubbing and scratching. Scratching of the skin and breaking of the horny layer can facilitate the skin infection. The habitual scratching of the back of the neck would explain the high incidence of boils in this place. The back of the neck is also a common place for acne, urticaria, angioneurotic oedema, seborrhoeic dermatitis, contact dermatitis to starched collars, fur collars, collar studs, hair dressings, scarfs and lichen simplex chronicus of Vidal. There were 17 patients (28%) in the 60 cases of boils suffering from boils at the back of the neck.

ALLERGIC INSECT BITES :

There were 10 patients (16%) in the group of 60 cases of boils who complained that their boils have started with insect bites. All ten of them suffered from angioneurotic oedema resulting from insect bites. Allergy to insect bites has been discussed by Hansel (1953).

Scratching of the itchy spot at the site of the bite would facilitate the boil formation.

THE ROLE OF FINGERS IN AETIOLOGY OF BOILS IN ALLERGIC PATIENTS :

Patients suffering from hay fever or allergic rhinitis have to blow and clean their noses frequently, using up a few handkerchiefs a day. The "allergic salure" of a child suffering from nasal allergy is a well known clinical sign. The distribution of boils indicates that fingers are transmitters of infection from nose to skin. There were 30 patients (50%) in this study who had boils in the proximity of the nose, on the face, forehead, back of the neck and temple. Out of these 30 patients with boils in close proximity of the nose there were 12 patients with a visible focus of infection in their nostrils.

The clothed areas of skin are seldom affected by boils. In this series of 60 patients there was one case with the boil in the axilla, one in the groin, two in the scapular region, one on the abdominal wall and one in the sacral region.

Gould and Cruinkshank (1957) showed that most cases of staphylococcal infection in general practice were autogenous and the route of infection was by direct or indirect contact with the nose. In over 90% of these cases the staphylococci isolated from the nose and the lesion were identical in phage type.

RECURRENCE OF BOILS :

Boils tend to recur in the same patients. In the 60 cases studied in this work there were 48 patients (80%) suffering from recurrent boils.

Gould and Cruinkshank (1957) observed that of the 189 patients with staphylococcal lesion 54% had recurrent staphylococcal infections in the previous two years. It is possible that recurrence of boils coincides with the recurrence of virulent forms of staphylococcus pyogenes in the nose or the exacerbation of allergic disease.

ALLERGIC AND ANAPHYLACTOGENIC PROPERTIES OF STAPHYLOCOCCUS PYOGENES :

Besides toxic properties of staphylococcus pyogenes, certain allergenic and anaphylactogenic properties have been described.

Kahn et al. (1951) described nucleoprotein, purified protein, purified polysaccharide and crude extracts of staphylococcus pyogenes. Immediate and delayed skin reactions have been observed to these staphylococcal fractions and they occurred more frequently in allergic than in non-allergic patients.

Loewenthal (1954) observed that positive patch tests to staphylococcus pyogenes were found more often in eczematous patients than in normal. Dworetzky et al. (1956) reported that all fractions of staphylococcus pyogenes can produce anaphylaxis on an isolated guinea pig's ileum. Cohen et al. (1957) produced fatal anaphylactic shock in rabbits by injecting them with staphylococcus pyogenes extract.

EXPERIMENTALLY INDUCED ECZEMA BY BACTERIAL PRODUCTS :

Staphylococci can produce eczematous lesions in animals by repeated cutaneous application of cultures or filtrates. Such sensitivity was produced also in eczematous and normal individuals. Exacerbation of eczema may occur after subcutaneous injections of autogenous or mixed vaccine (Loewenthal, 1954).

The intradermal tests to staphylococcal products were strongly positive in patients suffering from boils as shown in Part Two of this work. It is difficult to determine whether these reactions were of immunological or allergic nature or both. Elek (1959) pointed out that lesions caused by staphylococci can be explained by the direct toxic effect of staphylococcal products and there is no need to explain the lesions on the basis of hypersensitivity.

EXPERIMENTAL STAPHYLOCOCCAL INFECTION IN HYPERSENSITIVE ANIMALS :

Prigal (1957) sensitised mice with a combined pertussis serum mixture. Infective doses of coagulase positive staphylococcus pyogenes were injected intravenously after sensitisation. The infectability was determined by viable organisms found in various organs. These experiments showed that sensitisation with pertussis serum mixture renders the mice vulnerable to infection.

EXPERIMENTAL STAPHYLOCOCCAL INFECTIONS IN MAN :

Elek (1956) produced experimental staphylococcal infections in young volunteers. Freshly obtained pyogenic strain of staphylococcus from an abscess was injected in varying dilutions intradermally. The minimal pus forming dose was found to be 7.5×10^6 cocci. He pointed out that a nasal droplet of a 100 microns in diameter could contain only 500,000 cocci. He studied effects of plasma, mucin from the nasal droplets, toxic filtrates containing alpha-haemolysin and sutures as possible enhancing factors in initiating staphylococcal infection. Only sutures left in situ had the enhancing effect. This effect was attributed to a non-specific foreign body reaction.

EXPERIMENTAL INFECTIONS IN ALLERGIC PATIENTS :

Dowling et al. (1957) inoculated volunteers with nasal secretions taken from patients suffering from common cold. There were 143 allergic and 693 non-allergic subjects. Among the allergic volunteers 45% developed colds as compared with 31% among the non-allergic ones.

NATURALLY OCCURRING INFECTIONS IN ALLERGIC PATIENTS :

The writer (Bendkowski, 1958) observed that during the epidemic of Asian influenza in 1957, allergic patients were more severely affected by the disease than the non-allergic ones. The complications and the after-effects of Asian influenza were more frequent and more serious in the allergic patients than in the non-allergic ones.

THE GAMMAGLOBULIN AND ALLERGY :

It is accepted that in cases of agammaglobulinemia there are recurrent infections including recurrent boils. The patients in this study who complained of boils, did not suffer from any other infections at the time of examination. There was no clinical evidence that these patients were suffering from agammaglobulinemia. Crieep et al. (1956) found increased gammaglobulin levels in sensitised animals. Tuft (1956) reported normal or increased gammaglobulin in asthmatic children. There is no evidence that allergic patients suffer from agammaglobulinemia.

THE SUSCEPTIBILITY OF ALLERGIC PATIENTS TO BOILS :

There are no known reports about the incidence of boils in allergic patients. Sulzberger (1958) in his address to the

3rd International Congress of Allergology in Paris commented on the so-called atopic patients that they suffer often from infections. He called them "the stigmata patients" susceptible to atopic dermatitis, hay fever, asthma and infections.

It appears from this study that allergic patients do suffer from boils more often than the non-allergic patients. Diseases, including boils, do not result from one factor, but from multiple factors : heredity, climate, environment, noxious agents, organisms etcetera. In considering the relationship between the allergic diseases and boils it is possible to establish a link which is found in this work. This link between the allergic diseases and boils is the high rate of nasal carriers of staphylococcus pyogenes in allergic patients.

The sequent of events can be drawn as follows :

- (1) Respiratory allergy (allergic rhinitis, hay fever, bronchial asthma).

Congested mucous membranes of nose and sinuses.

- (2) Inhalation of staphylococcus pyogenes.

Multiplication of the organism in the nose and sinuses.

- (3) Wiping, touching, picking and blowing of the nose.

Contamination of the fingers with staphylococcus pyogenes.

- (4) Touching and scratching of the skin with the contaminated fingers in a vulnerable area : eczematous patch, urticarial weal, allergic insect bite.

Damaging the horny layer of the skin by scratching.

- (5) Implanting of staphylococcus pyogenes in the vulnerable area of the skin.

(6) Boil formation.

Touching and dressing of the boil. Contamination of fingers with staphylococcus pyogenes.

(7) Touching, wiping, picking and blowing of the nose.

Transferring the staphylococcus pyogenes from the fingers into the nasal vestibules.

Allergic diseases and boils seem to form a vicious circle. This study of boils points out that the allergic patients are potential nasal carriers of staphylococcus pyogenes. In an outbreak of hospital staphylococcal infection it is important to trace the source of infection and to identify the nasal carriers of staphylococcus pyogenes. In 1959 there was an outbreak of staphylococcal infection among the newborn babies in Barrow-in-Furness. Nasal swabs taken from the midwives showed that one of them was a carrier of staphylococcus pyogenes (Nelson, 1959). This midwife was suffering from allergic rhinitis. A nurse, medical practitioner or a ward maid suffering from allergic diseases can spread the staphylococci to susceptible patients.

The diagnosis of allergic diseases is not always easy. Hamilton and Bendkowski (1954) have discussed the problem of diagnosis of allergic diseases in general practice. A patch of infected eczema around the ankle may be hidden by the sock. Allergic rhinitis may be mistaken for colds. A careful history taking and a complete physical examination of the patient is essential in diagnosis of allergic diseases.

CONCLUSIONS.

- (1) Observation was kept on patients suffering from boils in an industrial general practice comprising 5,350 patients. Among these 5,350 patients there are 250 patients suffering from various allergic diseases.
- (2) Over the period of 15 months 60 cases of boils were treated in the practice. Among these 60 cases there were 53 patients who also suffered from allergic diseases.
- (3) The majority (78%) of the patients suffering from boils were nasal carriers of staphylococcus pyogenes.
- (4) The majority (80%) of the patients complaining of boils were sufferers from recurrent boils.
- (5) Studies of social status, living accommodation, eating habits, working conditions and general hygiene of the patients showed that boils do not occur in any particular group of people except the allergic patients.
- (6) Control studies on 100 allergic patients showed that 65 of them gave a history of boils and that 71 of them were nasal carriers of staphylococcus pyogenes.
- (7) Control studies on 100 non-allergic patients showed that 15 cases remembered suffering from boils in the past and 44 of them were nasal carriers of staphylococcus pyogenes.

The author puts forward the following thesis :

Boils as seen in general practice under normal living conditions

are found in allergic patients. Allergic diseases predispose the patients to be nasal carriers of staphylococcus pyogenes. The link between the boils and allergic diseases is found in the high incidence of nasal carriers of staphylococcus pyogenes among the allergic patients.

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