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GENERALIZED VACCINIA

BY

A. A. JUBB, M.D., D.Sc.

Medical Officer, Ministry of Health

The term "vaccinia" is used to denote the development and decline of an eruption at the site of inoculation with the virus of vaccinia, and the concurrent reaction of the body. Ordinarily the eruption is limited to that site, and occasionally "supernumerary" vesicles arise on the neighbouring skin. Rarely the eruption, with or without the supernumerary elements, appears also on other parts of the body, and this condition is known as "generalized vaccinia." The name is not good, because when vaccinia is running its course the virus becomes distributed throughout the body and vaccinia is therefore general (Cory, 1898; Committee on Vaccination, Report, 1928). "Vaccinal eruptive fever" was suggested, but in a successful Jennerian vaccination there is always eruption at the site of scarification, and usually there is some fever; on the other hand, apyrexia is not uncommon in generalized vaccinia. "Generalized cutaneous vaccinia" has been used, and is more satisfactory. There is convenience, however, in sticking to the designation that has been sanctioned by long use.

Vaccinia, therefore, is the normal result of a successful vaccination and is not a complication of vaccination, though generalized vaccinia may be regarded as such. Vaccinia is, in fact, a pathological entity with an exanthem, and like other exanthemata it has the stages of incubation, evolution, and decline; but as it is—to use the old distinctions—contagious and not infectious its eruptive capacity can be gauged only by the results of particular artifice and peculiar accidents. Generalized vaccinia has occurred in children who had sucked their vaccination pocks and in a child (though there is some element of doubt here) suckled by its mother, who was undergoing vaccinia. In persons previously insusceptible to ordinary vaccination it has been produced by the internal administration of vaccine crusts either ingested with food or insufflated into the nose. It has been produced in horses by the administration of vaccine lymph through the alimentary, circulatory, and respiratory systems (*Allbutt's System of Medicine*, 1912), and in other experimental animals by the intravenous injection of vaccine lymph (Blaxall, 1930). The number of these observations is very small and the proportion of eruptions very great compared with the vast number of human vaccinations that have run their course without a general eruption. To some degree, then, the occurrence of the condition is influenced by the route of invasion: the least provocative, or most inhibitive, is the skin, and the analogy to small-pox has long been recognized; for inoculated small-pox as practised during the latter part of the eighteenth century gave usually a much less general rash than did the disease acquired naturally through the respiratory passages, and might even not cause any eruption beyond that on and near the site of inoculation. This mildness cannot be claimed, however, for the inoculated small-pox of the preceding years, because then the eruptions were often profuse; in those years the inoculum

was taken from cases of natural small-pox, whereas later it was invariably taken from persons undergoing the inoculated disease. Ledingham's explanation for the reduced amount of eruption is that the artificial propagation by arm-to-arm passage modified the character of the virus, perhaps towards the character of the virus of vaccinia, and he bases this view on the fact that small-pox can become vaccinia by repeated passage through suitable animals.

It has, however, been suggested that some amount of antibody was produced by the skin at the site of inoculation of small-pox and was a factor in attenuation of the induced attack. As to vaccinia, though it is true that immunity can be obtained without vesiculation, Henderson and McClean (1939) have shown that the skin is of some importance in the production of immunity—a view taken by F. R. Blaxall. They investigated the effect of intracutaneous and subcutaneous vaccination with a bacteria-free elementary-body suspension of vaccinia virus on the production of immunity as tested by a cutaneous (scarification) vaccination with ordinary vaccine lymph six weeks later. Of 164 persons vaccinated in either of the above ways with elementary-body suspension, 75 developed a vesicle and 72 of them were immune to vaccinia on subsequent testing; of the 89 who did not develop a vesicle 31 only were found to be immune. As to cutaneous scarification, the 22 persons inoculated thus with ordinary vaccine lymph produced vesicles and all were immune on testing later, and of 24 scarified and vesiculated with elementary-body suspension 23 gave in due course a satisfactory result in immunity. There was correlation, therefore, between vesicle production and immunity.

In the intravenous experiments with ordinary lymph referred to above, generalized vaccinia often did not result, but later on it was demonstrated that adequate intravenous doses of the lymph and, better still, of certain strains of the virus (neurolapine and neurotesticular lapine) could give rise to typical vesiculation on the skin and marginal mucous membranes of animals, including monkeys, cats, and dogs. After full doses of these strains the virus could be recovered from most of the internal organs, and macroscopic lesions were found in most of the viscera (Douglas *et al.*, 1929). Thus, by stepping up the dosage and using certain strains of the virus, generalized vaccinia can be made fairly constant in incidence and often severe in attack.

The dosage, strain, and to some extent the portal of entry are factors, therefore, in the production of generalized vaccinia in experimental animals. In human vaccination the dose is small, the lymph is a dermal strain the potency of which is far below that of the experimental strains of the virus, and the entry is by the skin. It seems thus to be the office of the skin that is in question: does its failure to produce antibody, or sufficient antibody, at the vaccination site result in generalized vaccinia? But in those human subcutaneous and intracutaneous vaccinations in which the intention of avoiding vesiculation has been achieved generalized vaccinia does not seem to be more prone to occur than in Jennerian vaccinations, and, for what it is

worth, the observation can be made that in generalized vaccinia the vesicle of vaccination does not differ in development and aspect from those in normal cases. We may presume, then, that whatever be the relation of the vesicle to immunity, a lack—this is, a deficiency or an absence—of general response in immunity is the cause of the complication, if, indeed, a severe attack of an infection can be called a complication because it is rare.

Eczema Vaccinatum

Reference may be made here to eczema vaccinatum. This has been described as occurring in vaccinated persons with a history of attacks of eczema and in children suffering from eczema who, being in familial contact with someone undergoing vaccinia, had presumably been inoculated on the eczematous area through accident. An eruption of a vaccinal character appears on the eczematous site, which itself becomes intensely swollen and inflamed; the eruption may spread to healthy areas of skin, and when it is profuse the outlook is grave. Tedder (1936) considers that the conditions known as Kaposi's varicelliform eruption and pustulosis vacciniformis acuta are not only one and the same but are identical with eczema vaccinatum, and that failure to obtain a history of exposure to the vaccine virus has in most cases been the only reason for not identifying the former with eczema vaccinatum. It might be inferred, then, that an unhealthy state of the skin, some itching dermatosis, is the cause of generalized vaccinia, and, in alluding to Tedder, J. D. Rolleston (1937) gives the interesting fact that his own case of generalized vaccinia had recently suffered from varicella. A remarkable series of vaccinal eruptions on injured or diseased skin has been detailed by Nimpfer (1936). A child admitted to hospital with burns of the first and second degrees was vaccinated on admission; eight days later vaccinal pustules appeared on the burned surface. This was obviously the result of blood-borne virus; but thirteen days afterwards a patient in the same room and suffering from burns of the second and third degrees showed vaccinal lesions on the burnt surfaces, and ten days later a child with dermatitis, in a distant room but nursed by the same staff, developed generalized vaccinia. A fourth case, also of burns, developed vaccinal lesions six days later. Danziger (1907) recounted a similar occurrence in children affected variously with eczema and impetigo. These sorts of accident can be avoided by discretion in vaccination and care during vaccinia.

Though it is not disputed that a diseased or damaged part of the skin is vulnerable to direct infection by the vaccine virus, and perhaps also highly susceptible to the virus blood-borne (haematogenous) from the site of intentional vaccination, there is no evidence that generalized vaccinia—that is, the condition seen in the ordinary practice of vaccination—is due to a latent unhealthy state of the skin. Tedder's conclusion is: "True generalized vaccinia represents a disturbance (following vaccination) of the balance between the virus and the virucidal substances which it calls for in a person having an intact healthy skin, so that the virus which is disseminated haematogenously becomes active in the skin, producing a generalized vesico-pustular eruption, lesions on the mucosae, and general symptoms." As a balance can be disturbed to either side this statement is not precise, and its meaning can be put into three words—lack of antibody.

Incidence of Generalized Vaccinia

There is no doubt of the infrequency of generalized vaccinia. Numerous estimates of its incidence have been made, ranging from 1 in 10,000 to 1 in 100,000, and even 1 in 900,000 (Chaudhuri, 1940). For a considerable number of years all reports of cases of generalized vaccinia and other eruptions sent by the public vaccinators of England and Wales to Lieut.-Col. W. D. H. Stevenson, Director of the Government Lymph Establishment, have been subjected to special scrutiny, and to inquiry where deemed advisable, and the statistics so derived can be taken as ample for a fair computation. During the period July 1, 1932, to June 30, 1937, in 1,026,588 vaccinations 15 cases of generalized vaccinia and 11 doubtful cases were reported, giving, if the doubtful cases are included, an incidence rate of not more than 1 in 39,484 vaccinations (Shaw and Stevenson, 1939). If the doubtful cases are excluded the rate is 1 in 68,439. Since the publication of those figures a wider survey of the establishment records has been made by Stevenson and Cox; this covers

four years—1909-10 and 1921-2—taken at random, and the period from July, 1932, to June, 1941. The total number of vaccinations reported by public vaccinators was 3,289,733, with 34 accepted cases of generalized vaccinia; 35 reported cases were considered on inquiry to be doubtful enough to warrant exclusion. The accepted cases gave, therefore, an incidence rate of 1 in 96,756, with 4 deaths—a fatality rate of 11.7% and a mortality of 1.2 per million vaccinations. There was no death among the rejected cases.

Some years ago a questionnaire on the incidence of generalized vaccinia was addressed by the Ministry of Health to 28 public vaccinators selected on account of their long experience in vaccination. Replies were received from 26; of these, 17 reported that they had seen cases "occasionally" or "not for some years," or that they had seen one case within a stated period. Three had not seen a case in, respectively, 32, 28, and 27 years. As to supernumerary vesicles, one vaccinator was of the opinion that they occurred in less than 1% of vaccinations; another had not seen any in 27 years; and a third had not had more than 6 instances in many thousands of vaccinations.

Incidence in Adults.—It is widely believed that generalized vaccinia is more rare in adults than in children. Only 1 patient in the above 34 was beyond childhood, and was aged 17 years. The number of adult vaccinations reported by the public vaccinators is not available from our central records, but it can be said that in a period of several years during which nearly four million doses of lymph for adult use were issued by the Government Lymph Establishment only one instance of generalized vaccinia was reported among those adults. The experience of Froumy, reported by Haslund and quoted by Anders (1919), is surely unique. He vaccinated 175 cadets, all of whom had been successfully vaccinated in earlier life; of these, 64 had normal vesicles, 56 had small vesicles, and 55 were unsuccessful. Of the 64, 8 developed an eruption that may have been vaccinal, and 12 developed typical vaccinal pustules on face, trunk, and extremities; in 4 of the 12 the eruption was considerable, and it appeared even on the mucous membranes.

Secondary and Tertiary Vaccinations.—There is no record at the Ministry of generalized vaccinia in secondary or tertiary vaccinations, but Froumy's cases show that secondaries may not be exempt, and an instance in a tertiary was published by Stewart (1902). The risk is, of course, inversely proportional to the amount of immunity remaining from the previous vaccination.

Vaccinal Rashes

The various kinds of vaccinal rashes sometimes cause difficulty in diagnosis when small-pox is present in the district. During the small-pox epidemic of 1902 Chalke (1931) made a study of these, and he concluded that by far the greater number were accidental and either were in the nature of serum rashes (erythematous, scarlatiniform, morbilliform, and urticarial) or were due to the absorption of toxic products from the vaccinal site; that other symptoms of serum disease were not often encountered and the introduction of a small amount of serum in the operation of vaccination did not act as a sensitizing dose; and that vaccinal rashes of any type were rare among revaccinated subjects.

The rashes reported to the Ministry have been described by the public vaccinators as papular, pustular, punctate, erythematous, morbilliform, urticarial, roseolar, eczematous, and macular. From the records of six consecutive years Stevenson has computed that the incidence of all rashes, including generalized vaccinia and supernumerary vesicles (but excluding rashes near the vaccination vesicle and probably due to faulty dressings), was 1 in 7,755 vaccinations. It must be noted, however, that the occurrence of a vaccinal rash after a public vaccinator has ceased his routine visits to a normally progressing case of vaccinia may not be brought to his knowledge, particularly if the rash is mild and evanescent; doubtless, therefore, the true incidence is somewhat greater. But in a recent period of mass vaccination in Glasgow a ratio approximately as high as 1 in 4,000 was recorded; no instance of generalized vaccinia was found in a total of about half a million vaccinations (Bloch, 1942).

One case of mild pemphigus, one of petechial rash, and two of purpuric rash have come to our notice, but purpura

associated with vaccination is very rare; the number of recorded cases is probably less than a dozen, though Heaton (1940), in reporting a case, quotes a statement of Trant that the occurrence was noted as long ago as 1842. In the experience of Stelwagon (1902) the most frequent generalized manifestation was "a mixed type of urticaria and erythema multiforme, or better described as an erythema multiforme with often itching and other features of urticaria." It is probable that in the majority of instances the vaccinal rash is anomalous in its being a mixture of lesions and not a single dermatosis, and possible that allergy is an important factor in causation.

Vaccinal rashes may appear at any time in the course of vaccinia from the day after vaccination, the earliest being mainly the erythematous and urticarial, but the incidence of rash is low in the first week, and available figures indicate that the majority—say 80%—develop in the period from the 7th to the 11th day after vaccination.

Generalized vaccinia has no prodromal rashes: the occurrence of a rash prior to or along with the specific eruption is fortuitous. It is only a papular rash that should raise suspicion of generalized vaccinia, and even then the diagnosis should, as Shaw and Stevenson suggest (1939), be withheld unless the papules proceed to vesiculation. The eruption usually affects the trunk more than the limbs and, as mentioned before, it may appear on the mucous membranes. In a fatal adult case reported by Anders (1919) the eruption had extended to the trachea. Turnbull (1941) has published an unusual case of dysphagia due to swelling of the tongue caused by the eruption on it of two vesicles; the case, which was fatal, is of interest because of its extreme rarity. The only previously recorded instance of interference with feeding appears to be that of a case brought to the notice of the Royal Commission on Vaccination (1896); the presence of vesicles in the mouth prevented the infant from sucking, and death ensued.

Concurrence of Generalized Vaccinia and Post-vaccinal Encephalitis

The concurrence of two conditions so rare as generalized vaccinia and post-vaccinal encephalitis must be a very remote chance—one in many millions—and only 8 cases appear to have been described or mentioned. One reported by Weichsel (1931) may be accepted. A fatal case described by Paisseau and Scherrer (1929) had singular symptoms: the legs from the knees downwards and the feet were cold and blue, the forearms and hands were cold and blue, almost black. The general eruption consisted of 3 pustules near the vaccination pustules, 1 on the back of the arm, 1 near the axillary fold, and 1 on the upper part of the back—a distribution that hardly escapes from the category of supernumerary vesicles. These authors mention, without traceable reference, a case of generalized vaccinia and post-vaccinal encephalitis that had been published before theirs. Jorge (1927), on the authority of Garret, gave an account of a case of vaccinal eruption with meningeal symptoms, followed by blindness and deafness, that cleared up after five months. Jorge also mentions an encephalitic case of Netter and Cestas's in which a vaccinal eruption appeared on the thigh 14 days after vaccination; the site of vaccination is not stated. Mexico, however, provides the most remarkable record. In that country 8 cases of post-vaccinal encephalitis were reported in the decennium 1928-37; of the 4 that recovered, 2 had residual paralyses with mental disturbance and 1 had residual deafness. The patient with residual deafness, and 2 of those who died, had generalized vaccinia.

In England and Wales only one instance of the suspected concurrence of the conditions has been brought to our notice, and after inquiry it was concluded that neither of them existed. Case 114 in the Further Report (1930) of the Committee on Vaccination may, however, be a true instance.

Generalized Vaccinia of the Foetus

Though vaccinia rarely influences the course of pregnancy there is considerable evidence that vaccination late in the pregnancy confers some degree of immunity on the foetus; but the immunity is transient, and is lost in a few weeks after birth. There does not appear to be any record of generalized vaccinia in a pregnant woman, and therefore much interest is attached to accounts of foetal eruptions following vaccinia in the mother. Lynch (1932) has published an account of an

eruption, which he calls "pemphigoid vaccinia," in the premature and short-lived child of a woman vaccinated 27 days before the birth, and he is of the opinion that similar cases have been described in the past as intra-uterine variola. He has collected 8 cases from the literature, beginning with one recorded by Jenner; in all of them, as in his case, the mother was vaccinated because of the presence of small-pox either in the home or in the district, and none of the mothers developed a variolous eruption. If we reject one case (Siebold's) as too fanciful for credence it appears that the births took place from two to ten weeks after vaccination and that, of the 7 infants, 4 were stillborn, 1 was non-viable (5th month), and 2 died soon after birth. That these mothers passed through vaccinia and variola sine eruptione with variolation of the foetus is a probability too distant for contemplation, and in the light of Lynch's informative discussion it is reasonable to regard these as instances of generalized vaccinia of the foetus.

Auto-inoculation (Auto-vaccination)

Auto-inoculation is not generalized vaccinia; it is the result of the transfer of virus from the vaccination vesicle to one or more places on the skin, almost invariably by the fingers of the vaccinee and inoculated by scratching. For diagnosis the sites are suggestive, being commonly the face and the front of the body. Auto-inoculation sometimes induces generalized vaccinia; in this event, pocks do not cease to appear after suitable precautions have been taken, but continue to arise for as long, perhaps, as five or six weeks. The condition known as eczema vaccinatum has already been mentioned.

Post-mortem Findings

In the generalized vaccinia produced in rabbits by intra-venous inoculation, usually of extremely active strains of virus in very large doses, lesions have been found in the lungs, liver, spleen, and suprarenals. In human generalized vaccinia there has not been the introduction of an overwhelming dose or of a virulent strain; the reaction is due to an inherent susceptibility and, as in other acute infections, death can ensue from toxæmia rather than from visceral damage. In a case examined by Dible and Gleave (1934) there was some oedema in the lungs and congestion of the bases, otherwise the respiratory system was normal, and so was the heart. The liver showed two small white, solid areas, each about 3-4 mm. in diameter; both were on the surface and visible beneath the peritoneal coat. Apart from some slight fatty infiltration the organ showed no other change. In the spleen there were some congested areas but no other visible abnormality. The remaining abdominal organs exhibited no naked-eye changes. The central nervous system showed general congestion but no other naked-eye lesion. The lesions in the two pocks in the liver were almost pure necrosis with karyolysis of the liver cell nuclei and a rapid conversion of the tissue into a granular unstaining mass; the lesions were as sharply delimited as the pocks in the skin. The spleen had a considerable number of necrotic foci, the largest 0.5 mm. in diameter; their histological appearance corresponded to that described in the liver and skin—the same pure sharply circumscribed necrosis, absence of reaction, minimal infiltration with leucocytes, and karyolysis of most of the nuclei: briefly, pure necrosis without haemorrhage and with a minimum of reactive change. No lesions were seen and no virus was demonstrated in the brain. The authors point out the similarity of the epithelial lesions to those of the older descriptions of small-pox lesions rather than to those produced in thin-skinned experimental animals such as the rabbit.

Diagnosis

The virus of vaccinia has been demonstrated in the blood as early as the third day after vaccination; on the other hand, it has been shown that the excision of a normally progressing vaccination site as late as the fourth day can prevent the full development of immunity. In theory generalized vaccinia is a late starter; it cannot be ahead of the local vaccinal reaction, and in practice it rarely runs equal. The fourth day after vaccination may be taken as the earliest day of appearance, and by far the commonest period is from the ninth to the fourteenth day. Delay to the twenty-third has been reported, as in Froumy's case, and in this curious event it must be supposed that immunity had not been firmly established. The end-point of cropping is indefinite; the eruption does not

ordinarily go beyond one crop, but new crops may appear up to five or six weeks, though this is unusual. By Cory's law the time taken in the maturation of pocks should be inversely proportional to the degree of immunity, and rapid maturation of new pocks will indicate that immunity is being developed. In diagnosis the following considerations will be helpful:

1. Auto-inoculation should be excluded.
2. The eruption does not appear earlier than the fourth, and seldom earlier than the ninth, day after vaccination.
3. The eruption must be elsewhere than in the neighbourhood of the vaccination site.
4. There must be a vesicular stage.

The eruption may arise on any part of the skin—limitation to one sole has been reported—and within the mouth. The distribution is not specific, and any resemblance to that of small-pox is accidental. When profuse the elements may show much diversity in size, up to that of a sixpence or even larger, as contrasted with the almost uniform size seen in discrete small-pox.

Treatment

In some quarters it is the practice to seek to prevent severe reactions in adult primary vaccinations by puncturing and evacuating the vesicle on the seventh or eighth day after vaccination and applying a dressing of permanganate of potash. This is not free from the risk of impairment of protection, as immunity against small-pox is not satisfactorily established before the ninth day and it would not be justifiable as an attempt to prevent the unusual complication of generalized vaccinia. Mervyn Gordon (1941) has suggested, however, that permanganate of potash, to which the viruses of both vaccinia and small-pox are extremely susceptible, might be effectively used in treatment by the application of a wet compress of the permanganate solution to the vesicles of the eruption. Even in a dilution of 1 in 100,000, he states, permanganate can inactivate the vaccinia virus, but glycerin should not be added, for it inhibits the virucidal action. He advises also that in a severe case trial should be made of serum from a recently vaccinated person—a treatment which, in fact, he was the first to suggest in post-vaccinal encephalitis. The most potent serum, in his opinion, would be that taken from young healthy adults 14 days after vaccination.

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An account of a case of mycotic endocarditis has been given by A. Wikler and his colleagues (*J. Amer. med. Ass.*, 1942, 119, 333). The patient was addicted to heroin and had a mitral lesion. On two occasions during his life blood counts yielded a yeast-like growth subsequently demonstrated to be *Candida (Monilia) paracrusei*. The authors believe that careful laboratory work ruled out the possibility of contamination of the culture medium, and point out that during the past two years 5 cases of mycotic endocarditis have been recorded in cases of drug addiction; in 4 of these the infecting organism was *Candida paracrusei*, and in the fifth *C. guilliermondi*. The authors were unable to isolate *Candida* from samples of heroin, and point out that this fungus is frequently found on the surface of the skin.

THE PROGNOSIS IN CIVILIAN HEAD INJURIES

BY

ERIC GUTTMANN, M.D., L.R.C.P.Ed.

(From the Nuffield Department of Surgery and the Accident Service, Radcliffe Infirmary, Oxford)

The prognosis of accidents depends on many non-medical factors. Besides the results of organic damage there are social and psychological factors which profoundly influence the patient's health, happiness, and working capacity after an accident. Prognostic studies in the past have taken little account of these factors, though many discrepancies in recorded numerical results probably depended on such influences as the condition of the labour market at the time, the system of social insurance, and their consequent social and psychological effects.

The Accident and Rehabilitation Services which have recently been developed owe their existence largely to such considerations. In the publications on their organization, methods, and result very little reference has been made to the problem of head injuries, though the importance of these is far from negligible. Not only is their proportion among the accident admissions considerable—at this hospital about 30%—but their after-effects are generally regarded as serious in character and difficult to assess. It seemed of interest, therefore, to study the prognosis of head injuries, particularly at a time of comparatively standardized and favourable social conditions, when everybody has the choice of well-paid jobs and most employers are ready to facilitate gradual return to work.

All cases were treated by an active method of early rehabilitation. No patient was told to keep quiet; if he did so on account of unpleasant sensations he was early encouraged to move his head and body freely, to sit up, and, after a few days, to get out of bed. Lumbar puncture was carried out only where desirable for diagnostic purposes, and no dehydration was employed. Elsewhere I have described how, with this form of treatment, these patients suffered but little from headache (Guttmann, 1943). The same paper gives details of the severity and type of the accidents. The present paper deals with the results of the treatment on the loss of working time. Some references to earlier publications on the prognosis of head injury are appended. The figures reported are not easily comparable on account of the differences of time of follow-up, the proportion of cases re-examined, and the social conditions. Only Ritchie Russell (1932) has given a detailed analysis of similar material, and his figures are quoted on p. 95. But his patients were kept in hospital for at least three weeks.

Material

This paper is based on 300 consecutive admissions of head injury; among these were 255 civilians available for study. These cases, it must be emphasized, were the unselected accidents, mainly road accidents, of a mixed urban and rural area. Ten patients out of the 255 (4%) died; of the remainder 2 were permanently incapacitated owing to cerebral damage. The duration of the in-patient treatment is given in Table I.

TABLE I.—Duration of In-patient Treatment (245 Cases)

Up to 1 week ..	..	..	..	..	..	..	..	125
" 2 weeks ..	..	..	..	..	..	..	..	76
" 3 " ..	..	..	..	..	..	..	..	22
" 4 " ..	..	..	..	..	..	..	..	12
Longer ..	..	..	..	..	..	..	..	10

Table I shows that just over 80% of all cases were discharged from hospital within two weeks of admission. Among the 245 incapacitated patients are included all cases with injuries elsewhere: 73 had major injuries, such as fractures of bones. All cases of mild head injury (i.e., with a post-traumatic amnesia of one hour or less) were treated in hospital fourteen days or less; three-quarters of the cases of moderate severity (post-traumatic amnesia up to 24 hours) and one-half of the severe cases (post-traumatic amnesia over 24 hours) were discharged within the same period. All cases which stayed in hospital four weeks or longer did