PANOPHTHALMITIS AFTER A BLOOD TRANSFUSION* RESPONSIBLE ORGANISM, *BACILLUS CEREUS*

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A CONSIDERABLE number of cases of panophthalmitis attributed to the *Bacillus subtilis* have now been recorded (Poplawska, 1891; Römer, 1901; François, 1934; Greenspon, 1918; Motolese, 1936; Reese and Khorazo, 1943). In these cases the organism had an exogenous origin and entered the eye through a perforating wound or post-operatively. Davenport and Smith (1952) suggest that many cases of panophthalmitis said to be due to *B. subtilis* may in fact be due to *B. cereus*; they describe a case considered to be due to this organism entering the eye with an intra-ocular foreign body.

No case has been described of panophthalmitis due to an organism of the *B. subtilis* group occurring in an uninjured eye or in one that had not been operated on. It is for this reason that the following case is reported of endogenous panophthalmitis due to an organism of the *Bacillus subtilis* group (*B. cereus*) subsequent to a blood transfusion. The expression "*Bacillus subtilis* group" is here used as a convenient method of referring to species of genus *Bacillus* but excluding *B. anthracis* and *B. anthracoides*.

Case Report

A married woman was the mother of three children, the youngest being 8 months old. Since the birth of the last child she had had a secondary anaemia: R.B.C. 3,000,000; Hb. 58 per cent. After due consideration her doctor thought it wise to restore her blood level to normal by means of a transfusion.

The donor was a local, healthy, young male free of any clinical infection. His blood investigation was as follows: Group A; Rh-negative to both anti-D and anti-CD sera; Kline test negative. The blood was used 12 to 15 hours after it had been collected, and during this period it had been stored in a refrigerator.

The patient was admitted to hospital early on February 28, 1953, and any incompatibility was excluded by cross typing the bloods under consideration. The transfusion set used was the standard type with the usual filters, etc. The transfusion was begun at 10 a.m., and no difficulty was experienced in introducing the transfusion needle into a vein of the left cubital fossa.

After 800 ml. had been given the patient complained of nausea. She was slightly apprehensive and developed a marked thirst. The transfusion was stopped immediately.

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A little later she vomited but within a few hours felt well again. At 10 p.m. (12 hrs after the transfusion had been begun) the patient complained of pain in her left eye and noticed "large black spots" moving around in the temporal field of her left vision. These spots appeared to be within a few inches of her eye and were apparent whether the eye was open or closed. The following morning (March 1, 1953) the pain had markedly increased and her vision was now reduced to perception of light only. Shortly after this she was referred for opinion by her own doctor. On careful questioning, she gave no history which could suggest any previous eye pathology or trauma. When I first saw her (some 36 hrs after beginning the transfusion) she had severe pain in the left eye and there was no perception of light. The lids were somewhat oedematous and the conjunctiva chemotic. The eye was moderately proptosed and its mobility was reduced slightly in all directions. The cornea was oedematous and the epithelium showed bullae formation. There was a small hyphaema; the pupil was constricted and inactive and no red reflex was discernible on fundal examination. The eye was "stony hard" to palpation. The temperature and pulse were normal and remained so throughout the whole course of the illness. A full medical examination revealed no abnormality apart from a slight trace of sugar in her urine, which later disappeared. There was no clinical evidence of phlebitis in her left cubital fossa.

A full haematological examination was carried out and the results were as follows:

Red blood cells 5,100,000; Hb. 82 per cent.; White blood cells 64,000.

Differential count: neutrophils 96; lymphocytes 4.

Film: No immature white cells. No abnormality detected in red or white cells.

Platelets in the order of 200,000 per cmm. (i.e. within the normal limits).

Blood grouping: Group A; Rh —ive to anti-D and anti-CD sera.

Direct and indirect Coombs tests: negative.

Kline test: negative.

Blood urea: 40 mg.

Prothrombin: Control 17 sec. (nursing staff), Patient 22 sec.; Prothrombin index 78.

There was no evidence of haemolysis in the patient's plasma.

A catheter specimen of her urine was collected and a microscopic examination of an uncentrifuged specimen showed no abnormality. Dark-ground examination showed no bacteria and no red blood cells present.

The clinical findings mentioned above gradually progressed and some 48 hours after the transfusion it was obvious that the patient had developed a panophthalmitis. The oedema of the lids, chemosis, and proptosis were marked, and the eye was almost immobile. The cornea gradually became heavily infiltrated from the periphery inwards. The eye was accordingly eviscerated under general anaesthesia and it was noted that the vitreous contained frank pus which was moderately blood-stained. Cultures were taken on various media just before the operation from the conjunctival sac, and during the operation from the anterior chamber and vitreous. These were taken personally by the pathologist (Dr. G. F. Lumley) during the evisceration. A specimen of the eviscerated retina and choroid was retained for purposes of a direct smear.

The patient made a rapid uninterrupted recovery and was discharged 7 days after the operation. At no stage in her illness did the right eye show any abnormality on repeated external and fundus examinations.

Bacteriological Report

Cultures taken from the conjunctival sac just before the operation proved sterile, whereas all cultures taken from the anterior chamber and vitreous showed a growth of a member of the genus *Bacillus* only. Smears from the eviscerated retina and choroid showed intra- and extra-cellular gram-positive, spore-bearing bacilli. Representative cultures were sent to the Commonwealth Serum Laboratories, Melbourne, Victoria, and the following report received:

The cultures were examined by our research department. The methods used for the classification of the organisms were those described by Knight and Proom (1950).

The taxonomy of this group is difficult and is based on observations made by growing the organisms on special media, and performing biochemical tests under chemically defined conditions. We confined ourselves to a limited range of tests, using Table 7 in the paper of Knight and Proom with the following results:

Morphology: Gram-positive sporing rods. Spores oval, thin walled, extending the bacterial body only slightly.

Nutritional Requirements: Cannot utilize ammonia as the only source of nitrogen, will grow in the "ammonia basal medium" (a mixture of inorganic salts) after the addition of "medium 7 AA" (a solution of seven amino acids) and does not require other metabolites.

Fermentation of Sugars: In the ammonia basal plus 7 AA medium will ferment glucose, but not xylose or arabinose.

Reference to the above Table indicates that the characters of the organism are compatible with its classification as *Bacillus cereus*. The colonial appearance of the cultures on agar is also in agreement with this diagnosis.

I hope that you will appreciate that our tests on your cultures do not prove the identity of the organism beyond all doubt.

Representative cultures were then sent to the Wellcome Research Laboratories, Beckenham, Kent, for further identification, and Mr. Proom reported as follows:

Cultures were identical and identified as typical *B. cereus*; the following description applies to all three cultures:

Morphology.—Gram +ve rods, width 0.9μ , thin walled central oval spores, sporangium not swollen.

Colonies on nutrient agar.—Large, flat, rough, with characteristic mottled appearance.

Fermentation tests.—Acid from glucose but not from arabinose or xylose.

Hydrolysis of starch.—Positive.

Hydrolysis of gelatin.—Positive.

Hydrolysis of casein.—Positive.

Production of acetylmethylcarbinol.—Positive.

Lecitho-vitellin reaction.—Positive.

Growth at pH 6.0.

Growth under anaerobic conditions.

Nutritional requirements.—Amino-acids but no "essential metabolites".

Discussion

There are numerous cases of panophthalmitis of endogenous origin on record in many and varied diseases (*e.g.* puerperal fever, septic abortion, pyelitis, pneumonia, meningitis, otitis media, endocarditis, and even abscesses and boils). However, a panophthalmitis occurring in a healthy individual (apart from a secondary anaemia) following upon a blood transfusion is a very rare event. That incompatibility was not a causative factor is shown by the blood investigations performed when the patient was first seen, and by the later examination of the patient's and donor's bloods. The blood grouping details (Commonwealth Serum Laboratories, Melbourne, Victoria) are as follows:

Test ...	A-B-O	M-N-S	Rh	Duffy	Kell	Lewis	P
Recipient	A2	MNS	rr	—	—	—	+
Donor ...	A1	MNS	rr	+	—	—	—

In the seven blood group systems there is a difference in the subgroups of A, and the only other antigen shown to be possessed by the donor and not by the recipient is Duffy (Fy^a).

In the tests performed on the patient's serum no evidence of atypical antibodies was detected. Tests were made for saline agglutinating and albumin antibodies, and by the indirect Coombs test using the donor cells and other cells especially selected from our panel.

The causal organisms in reported cases of panophthalmitis of endogenous origin include all those which may cause pyaemic manifestations. The streptococcus haemolyticus is probably the most common, while the pneumococcus is the next in importance. Other organisms include the meningococcus, staphylococcus, gonococcus, and the *Bacillus coli*, but in many cases the causal organism has not been isolated despite thorough investigation. In the case here reported the organism responsible was one that is non-pathogenic except for ocular tissues and one that to my knowledge has not previously been isolated in endogenous panophthalmitis. That an organism of the *Bacillus subtilis* group (*B. cereus*) was responsible is proven by its absence in the conjunctival cultures and its presence in all the intra-ocular cultures taken. This is further substantiated by the presence of gram-positive, spore-bearing rods within the polymorphs seen in a direct smear made from the eviscerated ocular tissues.

Every possible aseptic precaution had been taken during the collection and transfusion of the blood, and the donor was a healthy man free from clinical infection. Nevertheless, the question whether the ocular infection may have been due to a minute embolus of a *Bacillus subtilis* group organism, which resulted in some way from the transfusion, must be considered, for it is recognized that these organisms are very common contaminants despite all precautions. As they are non-pathogenic except for ocular tissues, the patient may have had numerous such emboli circulating within her vascular system and all save one may have terminated extra-ocularly causing no disturbance. Whether the odd embolus—if this be the origin of the infection—was arrested in the central retinal artery (or branch), in a short or long posterior ciliary artery, or even in an anterior ciliary artery, cannot be postulated, as the patient was not seen until the ocular condition was well advanced and examination of the fundus impossible.

It is also interesting to note that a severe panophthalmitis, in which the patient was obviously very ill, caused no rise in temperature or pulse, but produced a leucocytosis in the order of 64,000.

Summary

A case of panophthalmitis due to an organism of the *Bacillus subtilis* group (*B. cereus*) has been described. This followed a blood transfusion for

a secondary anaemia, and it was thought that an embolus of the above organisms lodging within the ocular circulation was the cause.

I am greatly indebted to my partner, Dr. T. Boyd Law, for also seeing this case. He upheld my diagnosis and agreed with the need for surgical intervention. Without the valuable assistance of Dr. G. F. Lumley of the Commonwealth Health Laboratory, Lismore, N.S.W., the laboratory investigations would not have been possible. I also thank Dr. D. Gillies for his general medical investigations, Dr. F. G. Morgan, Director of the Commonwealth Serum Laboratories Melbourne, Victoria, for his work in supplying independent confirmation of the blood groupings and the bacteriological report, and Mr. Proom of the Wellcome Research Laboratories, Kent, for his bacteriological report.

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