R35.2

D.P.H.

Notes on Water

Bacteria in water

1. Natural water bacteria
   Many rod-shaped and coccal forms, often pigmented.

2. Soil bacteria
   Especially during rain. Spore-bearing aerobes, resistant to chlorine, etc. Bact. aerogenes.

3. Sewage bacteria
   (a) Intestinal
   (i) Coli-aerogenes Differentiation

Organism	Indole	V.P.	M.R.	Growth in citrate	Gelatine liquefaction	Gas in MacC. 44°	Source
Coli Type I	+	-	+	-	-	+	Mammalian faeces
Coli Type II	-	-	+	-	-	-	Non-excretal
Intermediate I	-	-	+	+	-	-	Dust or Soil
Intermediate II	+	-	+	+	-	-	Dust or Soil
Aerogenes I	-	+	-	+	-	-	Dust from grains or foodstuffs
Aerogenes II	+	+	-	+	-	-	Dust from grains or foodstuffs
Cloacae	-	+	-	+	+	-	Dust from grains or foodstuffs

   (ii) Faecal Streptococci) confirmatory of faecal
   (iii) Cl. welchii) pollution

   (b) Sewage bacteria proper
   Proteus. Cl. sporogenes.

Factors affecting bacterial flora in water

Only repeated examinations likely to be of value.

A. Type of water.
   Surface - more liable to surface washings, dust, sewage and other pollution.
   Deep - more pure as has percolated through soil.

B. The more available food (organic matter) the more bacteria.

C. Temperature.

D. Sunlight.

E. Acidity. F. Protozoa. G. Rainfall. H. Season.

I. Effect of Storage (Houston's figures for Thames water)

	22°	37°	Coli in 0.01 cc.
River Thames	4465	280	10.1% of samples
After 15 days storage	208	44	1.1% " "
Reduction	95.3%	84.3%	89.1% " "

J. Filtration.

Interpretation of results. Points worth remembering.

Evidence is circumstantial - aim to detect possibility of intestinal pollution, i.e. potential pathogenicity.
Repeated counts essential, any rise to be explained.
22°/37° ratio usually 10/1. Significance of alteration.
"Presumptive Coli" in G.B. usually true faecal coli, in tropics more often aerogenes-intermediate.
Ideally should be none in 100 cc. of more. In practice

< 2	per 100 cc.	allowable
> 10	" "	"unsuitable" - investigate
3 - 9	" "	differentiate coli-aerogenes

Aerogenes probably lives longer in water than coli.
Purified water giving coli rise - investigate filters.
Chlorinated water usually coli-free.

Standards. (Only as a rough guide)

	Deep well or Spring		Shallow well, upland surface, filtered water
Plate count 22°	10-200	per cc.	50-500
Plate count 37°	1-10	" "	5-30
Faecal coli	<1	" 100 cc.	<5
" streps.	<1	" "	<5
Cl.welchii	<1	" 1000 cc.	<5

The typically water-borne diseases

Typhoid and paratyphoid
Dysentery.
Cholera.

Wilson and Blair medium

Used for isolation of enteric group from sources where likely to be scanty, e.g. sewage.
Bismuth-sulphite glucose brilliant-green agar.
Typhosum colonies are jet black shining with a "petrol-on-water" sheen round them.

MENINGITIS

An inflammatory affection of the membranes surrounding the brain and spinal cord.

May be (a) primary - the more important form and caused nearly always by the meningococcus (N.meningitidis). This is known as cerebro-spinal fever. Some primary cases are due to infection with H.influenzae, sporadically or in epidemics of influenza. This form simulates the meningococcal form closely.

(b) Secondary to infection elsewhere, due to infection with
(1) Str.pneumoniae, secondary to the pneumonias or middle ear disease
(2) haemolytic streptococci " " wounds of skull " " " "
(3) Myco-tuberculosis " " infection of lungs or elsewhere.
Secondary form usually affect children and are nearly always fatal.

Cerebro-spinal meningitis

May be acute or chronic and may occur sporadically or epidemically. The clinical condition was first described in 1805, following an epidemic at Geneva. The meningococcus was first isolated from the acute infection and described by Weichselbaum in 1887 in Vienna. Epidemics have been described in most countries during the last hundred years. The disease is tending to increase in geographical distribution and in number of persons affected. Epidemics have low morbidity rate (0.01 to 0.5% of population at risk) and high mortality rate (70% on average or from 39% to 90%)

Age Incidence. More common in children especially 0-5 years of age

Occupational Incidence. More common in soldiers and miners (hence in males more than females)

Seasonal Incidence. More common in winter and spring (cold and damp weather)

Other predisposing factors probably (a) overcrowding indoors and (b) fatigue.

Mode of Spread of Infection

Endemic in large towns, with occasional sporadic cases.

Epidemics at intervals, with irregular spread, both as regards place and time intervals. Followed by remissions and intermissions.

Route of Infection

Reaches nasopharynx by air-borne infection, droplet infection from carriers, contaminated handkerchiefs, bedding etc., probably negligible factors owing to ease with which meningococcus is killed by drying. May or may not give rise to local signs of infection. Extension of infection to meninges then may occur but whether directly or by blood stream not yet known.

Diagnosis - by examination of
(a) cerebro-spinal fluid, divided into three portions:
  (1) centrifuged deposit examined microscopically - supernatant used for precipitin test with type antisera.
  (2) immediate plating - examination of plates for colonies of meningococci - preparation of suspensions for agglutination with type antisera, by slide or waterbath.
  (3) incubation of spinal fluid with subsequent subcultivation and identification of colonies.
(b) naso-pharyngeal swab plate - sometimes positive when spinal fluid negative - may give better growth than spinal plate for preparation of agglutination suspensions.

Meningococcus identified by cultural morphological fermentative and serological tests.

Blood culture (25%+ in 1st week), and demonstration of agglutinins in patient's serum not adopted as a routine.

Prophylaxis

Carriers. The carrier rate varies with time of year and with different communities and institutions, up to 20% of normal healthy civilians, though usually about 10%. In schools etc. often low, 2-5%. Carriers may be contact or non-contact, and may carry profusely or scantily. Contact carriers and those carrying profusdy tend to carry longer than the others, for months or even years.

Prevention of Spread of Epidemic

1. Isolation of carriers not usually practicable owing to high carrier rate. When attemptedhas been shown to be successful. But when ever possible prevent carriers from coming into contact with youg children and expecially from sleeping in same bedrooms.
2. Reduce overcrowding as much as possible in sleeping quarters and ventilate adequately. Advise as far as possible an open-air life for this tends to reduce carrier rate considerably.
3. Nasal disinfection or treatment with immune serum for carriers generally regarded as useless.
4. Prophylactic vaccination up to the present has not given significant protection.

Serum treatment - depends for success on:
(a) mode of preparation of antiserum and its standardization.
(b) dose of antiserum employed.
(c) route of injection.
Under favourable circumstances, good results obtained especially with Type I antiserum (mortality rate reduced by over 50%). Early administration essential. The beneficial effect of repeated lumbar puncture by itself difficult to assess, probably considerable.

	G.	M.	S.
Pharyngeus	+	+	+
Meningo	+	+	−
Gono.	+	−	−
Catarrh	−	−	−

Gonly: Meningo.
C. Cant.

Main Sub-divisions of Neisseria

Organism	Morphology	Growth characteristics	Fermentation reactions			Types or Varieties
			Glucose	Maltose	Sucrose	
N.gonorrhoeae (Gonococcus) The etiological agent of gonorrhoea	Gram-neg.coccus,oval or spherical,often in pairs with adjacent sides concave. Size variable, average 0.8 x 0.6μ Mainly intracellular diplococci in gonorrhoeal pus	On agar. No growth. On serum agar 24-48 hrs. at 37°C. Poor growth - very small round colonies 0.1-0.5 mm. in diameter; greyish white, translucent; smooth surface, somewhat viscid and moderately easily emulsified. Grows better on heated blood (chocolate) agar.	A	-	-	Probably two main serological types. Type I isolated from acute infection. gradually changes to Type II on subcultivation in laboratory. Type II also isolated from chronic infection. Many intermediate strains occur. The two types have different colonial appearances.
N.meningitidis (Meningococcus) The etiological agent of cerebrospinal meningitis	Gram-neg. coccus,oval or spherical,often in pairs with adjacent sides faltened. Size variable 0.8 x 0.6 μ on average. Mainly intracellular diplococci in cerebrospinal fluid.	On agar. Usually no growth. Old stock cultures may grow poorly. On serum agar 24-48 hrs - 37°C. moderate growth. Colonies 1-2 mm. in diameter. Bluish-grey, translucent, smooth surface, butyrous and easily emulsified.	A	A	-	Four main serological types described (Gordon). Many strains belonging to Type I and Type III show considerable antigenic overlap by agglutination. Other strains isolated of these types are more specific. These should be used for preparing agglutinating sera. Types I and III are known by some workers as Group I (Griffth). Type II and IV in the same way have been classified as Group II. Group II strains more often associated with sporadic cases in children. Also usually found in non-contact carriers. Group I more often associated with epidemics in adults. All four type sera used in treatment.

Organism	Morphology	Growth characteristics	Fermentation reactions			Types or Varieties
			Glu-cose	Mal-tose	Suc-rose	
N.pharyngis non-patho-genic commensal of naso-pharynx	Gram-neg. coccus, oval or spherical, arranged in pairs, tetrads or more often in dense clumps	On agar, 24 hrs. at 37°C. Good growth. Colonies 1.3 mm. in diameter, white, greyish or yellow, opaque. Usually rough surface, dry, brittle, adherent to medium and very difficult to emulsify. Smoother varieties may occur. Grows at 22°C.	A	A	A±	Many different varieties described on basis of growth characteristics and fermentation reactions. Some produce yellow pigment - N.flava i, ii and iii. These may show a smooth form of growth. Another variety has been described giving rise to a mucoid growth consisting of capsulated cocci - Diplococcus mucosus.
N.catarrhalis non-patho-genic commensal of naso-pharynx	Similar to N.pharyngis	Grows on agar at 37°C. also at 22°C. Good growth. Colonies usually resemble those of meningococcus on serum agar but sometimes appear rough as in pharyngis	-	-	-	Rough and smooth forms occur, differentiated from all varieties of N.pharyngis by their failure to ferment any sugars.
N.flavescens occasionally causes cerebro-spinal meningi-tis	Similar to N. meningococcus	Grows on semi-solid agar. On serum agar resumbles the meningococcus but is less moist and produces golden-yellow pigment	-	-	-	Antigenically form a homogeneous group different from N. gonorrhoeae and N.meningitidis

D.P.H

Whooping-cough

H. pertussis: Gram-negative, non-motile, minute bacillus.

Culture difficult: best on Bordet-Gengou's potato extract-glycerine-blood (15-30%) agar. Half pearl colonies, 48 hours.

Freshly isolated smooth (Phase I) strains___ II__ III__ IV (rough) rapidly. [Leslie and Gardner]

Diagnosis (1) Cough-plate, positive 1st week, useless after third.
(2) Complement-fixation, positive from 3rd week till convalescence. — negative again in a few months. may be negative altogether in some cases

Prophylactic vaccines - must be Phase I: still under test, but promising. Immunize 9-15th month, 3-4 large doses ($10,000 \times 10^6$)
[Madsen: Sauer: Kendrick and Eldering
e.g. K and E. Vacc. 712 exposed 60 pertussis 4
Controls 882 " 84 " 63]

Therapeutic vaccines - no evidence in favour.

Pneumonia

Str. pneumoniae: Gram-positive, lanceolate pairs or short chains of cocci: capsulated in tissues.

Culture - small round colonies, α-haemolysis: draughtsman 'ringed' or plateau (esp. Type III, mucoid often).

Bile-soluble, ferments inulin.

Specificity determined by capsular polysaccharide - thus 32 types (I, II, III and Group IV). "Species" CH and a nucleo-protein common to streps., etc.

Dreech

Typing - (1) Neufeld - capsular swelling in presence of specific serum.
(2) Mouse-typing of sputum.
(3) Slide-agglutination of culture-sediment.

Disease - Appearance of antibodies coincides with crisis.
Bad prognosis in bacteraemia
Types (1) Normals IV > III > II > I
(2) Pneumonia I > IV > II > III
(3) Fatality III > II > I > IV

Type III rare in England

Serum therapy

Animal experiment satisfactory: type-specific.
Standardization by mouse protection test against Standard Serum.
Type I serum will save lives of 1 in 3 who would otherwise die.
Type II rather less effective.
Type III poor.

there is presumptive evidence based on seasonal experience such as mice and rabbits, that immunization with particular types of the pneumococcus I, II will increase the resistance to infection with these types

Mortality I and II [Cecil] - Serum 20.1% controls 31.2%.

Dosage - 10,000 units i.v. I and II, 8-12 hourly, till temperature falls. When typed, substitute specific type, or discontinue if not available.

Vaccines

Animal work satisfactory: type-specific
Human trial difficult and disappointing
Experiences: Rand mines, Army, Indian troops
Even if benefit, N.B. 30-50% are types other than I,II,III.

Collection Number: AD843

XUMA, A.B., Papers

PUBLISHER:
Publisher:- **Historical Papers Research Archive**
Location:- **Johannesburg**
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