

ANNEX

EXAMINATION OF CHOLERA-SUSPECT STOOL SPECIMENS

In place of the instructions for the laboratory diagnosis of cholera by Ahuja and colleagues (1950, 1951), which were appended to the text of Chapter 7 when that was first published in the form of a separate article in the *Bulletin of the World Health Organization*, it seems well to reproduce here part of a new set of such instructions compiled, in consultation with an international group of outstanding experts, by Burrows & Pollitzer (1958) and also published in the *Bulletin*. It would have been redundant to reprint here the first part of that compilation, which deals in summary fashion with the methods of collecting and preserving specimens and of preparing culture media and reagents for cholera laboratory work, as ample attention has been paid to these topics in the main text of this book. Only the second part of the new instructions, therefore—summarizing the methods of examining cholera-suspect stool specimens—is given below, in a somewhat abridged form.

Examination of Specimens

The cholera vibrio is excreted in large numbers, often in practically pure culture, in the rice-water stools characterizing the early untreated stage of the disease, and its isolation is relatively simple. The proportion of vibrios found in stool specimens taken on the second day of the disease, i.e., after the onset of general symptoms, may be greatly reduced and make up as few as one colony in 100 growing up on directly inoculated solid media. Thereafter, the vibrios may continue to be difficult to find on direct culture, or may apparently increase in abundance; in general, they are disappearing rapidly by the sixth to seventh day.

The administration of antibacterial drugs such as sulfonamides, tetracyclines and chloramphenicol appreciably reduces the period over which positive cultures may be obtained, though the disease process is apparently unaffected.

Thus two factors affect the successful isolation of *V. cholerae* for diagnostic purposes—namely, the stage in the disease during which the specimen is taken, and whether or not antibacterial substances have been administered for therapeutic purposes before the specimen is taken. In general, the cholera vibrio is isolated in about 50% of cases when the specimen is taken during the acute stage of the disease and inoculated directly on to solid media, and isolation is successful in 90%-95% of cases when more than one specimen is taken and/or more than one culture medium is inoculated.

Microscopic examination

Earlier workers attached considerable significance to the demonstration of morphologically characteristic *V. cholerae* in Gram-stained, heat-fixed smears of rice-water stool or a flake of mucus. Such direct microscopic examination is now regarded as of little or no value, in part because *V. cholerae* cannot be differentiated with confidence from cholera-like vibrios or from coliform and related enteric bacilli on morphological grounds alone, and in part because *V. cholerae* in such preparations frequently shows a large proportion of atypical cells.

Enrichment culture

Preliminary culture in fluid media to give a relative increase in the proportion of *V. cholerae* over that of extraneous micro-organisms present in the specimen is often desirable, especially when the specimen is taken later than 48 hours after the onset of the disease, and is essential to successful isolation of the micro-organism from specimens taken after four to six days. The fluid media described in Chapter 7—namely, peptone water (pages 533-536), bismuth-sulfite fluid medium (pages 539-542), and potassium-tellurite medium (page 542)—may be used for this purpose.

The amount of inoculum is inversely related to the numbers of *V. cholerae* suspected to be present. For example, a flake of mucus from a rice-water stool may suffice, or the medium may be prepared at double strength and inoculated with an equal volume of faecal suspension. The enrichment culture may be incubated for a few hours only (as little as two hours in the case of specimens taken during the acute stage of the disease) or for as long as 6 or even 12 hours (in the case of specimens from convalescents), and when the incubation time is extended it is desirable to subculture at more than one time-interval. The vibrios grow rapidly in the form of a thin film on the surface of the medium, and a loopful of this material is used as inoculum for culture on solid media.

Isolation in pure culture

Agar media should be inoculated directly with specimens taken during the acute stage of the disease, as well as with an inoculum from an appro-

priately incubated enrichment culture, if the latter has been made. One or more of the solid media favouring the growth of *V. cholerae* described in Chapter 7—namely, bile-salt agar (pages 564-565), Aronson's medium (page 558), and modified Wilson & Reilly bismuth-sulfite agar (pages 565-566)—are used for this purpose.

After 18 hours' incubation *V. cholerae* appears on bile-salt agar as small colonies, 1 mm or less in diameter, that are raised, smooth and completely translucent, and literally dewdrop-like in appearance, thus being readily distinguishable from coliform and similar bacilli. Colonies of cholera-like vibrios and *Alcaligenes faecalis* are closely similar, but may show a very slight opalescence.

On Aronson's medium minute colonies of *V. cholerae* appear as early as after 10 hours' incubation, and after 15-20 hours not only increase in size but also take on a bright-red colour. This coloration is not specific for *V. cholerae*, but is only indicative of fermentation of the sugars contained in the medium.

On bismuth-sulfite medium *V. cholerae* appears after 12 to 18 hours as yellowish-brown colonies that, in the case of some strains, may acquire a dark metallic lustre on continued incubation. This appearance, while characteristic, is not specific for *V. cholerae* in that *Proteus* species give closely similar colonies.

Heat-fixed smears should be prepared from the characteristic growth on one or another of these media and stained by Gram's method. The colonial growth appearance, coupled with the demonstration of the Gram-negative curved rods characteristic of *Vibrio* morphology, provides evidence consistent with the assumption that the micro-organisms are *V. cholerae*, but identification of the latter can be regarded as no more than presumptive at this point.

Identification

The identification of *V. cholerae* is based upon: (a) its biochemical characteristics, i.e., the fermentation of sucrose and mannose but not arabinose, the reduction of nitrate to nitrite and the formation of indole from tryptophane to give the cholera-red reaction, and a negative Voges-Proskauer reaction; (b) its failure to haemolyse goat or sheep erythrocytes under appropriate conditions; and (c) its agglutination in O group I antiserum.

A subculture of the colonially and microscopically typical *V. cholerae* is prepared from the isolation plate culture and used to inoculate media for biochemical tests. These include one tube each of the sugar broths, sucrose, mannose and arabinose, a tube of peptone water for the cholera-red test, and a tube of glucose/phosphate/peptone-water for the Voges-Proskauer test. In addition, a tube of isotonic Douglas broth is inoculated for the haemolysis test (see below).

Biochemical reactions. The fermentations should be read after 18-24 hours' incubation to avoid the late fermentation of arabinose that occurs with some strains. The nitroso-indole reaction, or cholera-red test, is carried out by adding concentrated sulfuric acid, about 1 drop per ml of culture, to the peptone water culture after 24 hours' incubation; a positive reaction is indicated by the development of a crimson to ruby colour, appearing more or less rapidly on the surface and then spreading to the whole of the mixture two to three hours after the addition of the reagents.

The glucose/phosphate/peptone-water culture is incubated for two to four days, although according to Taylor, Pandit & Read (1937) positive reactions may be obtained with cultures incubated for 24 hours. To 1 ml of the culture are added 0.6 ml of a 5% solution of α -naphthol in absolute ethanol and 0.2 ml of a 40% solution of potassium hydroxide. The reagents are added in the order indicated, and it is important to shake for about five seconds after the addition of each reagent. A positive reaction is indicated by the development of a crimson to ruby colour in the mixture two to four hours after addition of the reagents. Standard procedures commonly specify that the test should be read not later than four hours, but some workers with *V. cholerae* read the test as late as 24 hours afterwards.

Haemolytic activity. In assaying the haemolytic activity of *V. cholerae* and related vibrios it is of primary importance to distinguish between haemolysis as observed on blood-agar culture, and the lysis of suspended erythrocytes in admixture with a suspension or culture of the micro-organisms. Thus many strains of true *V. cholerae* show the zones of complete clearing of β -haemolysis around colonies on a blood-agar plate while others do not, though neither lyse red blood cells in suspension under the conditions indicated below. The apparent contradiction was resolved by van Loghem (1913), who established that the haemodigestion observed on blood-agar cultures and the haemolysis of suspended erythrocytes were basically different processes.

The test for haemolytic activity of vibrios, or Greig test, is carried out by adding 1 ml of a 3% suspension of erythrocytes to 1 ml of either a 24-hour culture of the micro-organisms in isotonic Douglas broth or a suspension of the micro-organisms harvested from an agar culture in isotonic saline and containing about 2000 million vibrios per ml. Of the two, the broth culture is regarded as preferable. Goat erythrocytes were used in the test as originally devised, but sheep erythrocytes are at least equally satisfactory, if not preferable; human red blood cells are not suitable for the haemolysin test for differentiating *V. cholerae* from the haemolytic (to goat and sheep cells) El Tor vibrios. The mixture is incubated at 37°C for two hours, read, stored overnight in the refrigerator, and read again. A positive reaction is indicated by clearing of the red-cell suspension

and liberation of free haemoglobin. The haemoglobin is frequently reduced and the haemolysis is usually not a complete sparkling haemolysis, but the test can be read without difficulty.

Agglutination. Since *V. cholerae* is agglutinated by O group I antiserum it is said to be "agglutinable" while vibrios of other O-antigenic specificity are "inagglutinable". This terminology is not to be taken to imply that serologically unrelated vibrios are not agglutinated in their homologous antisera.

The agglutination test may be carried out as a rapid slide-agglutination, either using morphologically typical colonies taken from the isolation plate or growth from an agar-slant subculture. Alternatively, the agglutination may be the usual tube titration, using a suspension of the microorganisms in isotonic saline and serial dilutions of 2ⁿ of antiserum.

In the rapid slide-test a loopful of isotonic saline and a loopful of antiserum, appropriately diluted as determined by prior test against known strains of *V. cholerae*, are placed side by side on a clean glass slide. Bacterial growth from an agar culture is then suspended in the saline to give a heavy milky suspension, and this drop of suspension is then stirred thoroughly into the drop of antiserum. A positive reaction is indicated by the development of a curdled appearance, usually within one to two minutes, which is apparent to the naked eye and, if desired, may be examined under a hand lens or dissecting microscope. It is essential that the test be controlled with a suspension of the bacteria in saline without antiserum. By the third day of the disease, R forms of the vibrio may be encountered that are spontaneously agglutinable in salt solution; obviously this control should be negative. In the event of saline-agglutinable forms being found, it is often possible to obtain a stable suspension by reducing the salt concentration to 0.5%.

Bacterial agglutination in serial dilutions of antiserum in the tube titration to titres within a dilution or two of that obtained with homologous antigen are more dependable evidence of the serological identity of the organisms tested. Normal rabbit serum frequently agglutinates *V. cholerae* in dilution as high as 1/50, and it is preferable that the serum dilution series begin at a 1/100 dilution. High-titred sera prepared by hyperimmunization are more satisfactory than sera with agglutinin titres of 1:2000 or less. It is essential here also that saline control tubes be included in the titration. A suspension containing 2000 million vibrios per ml (1 mg (dry weight) per ml), corresponding approximately to 5 units of the International Reference Preparation for Opacity (Maaløe, 1955), is a satisfactory agglutinating antigen.

Either of the above methods may be used to type *V. cholerae* as the Inaba or Ogawa serotype. Such typing is not essential to the laboratory diagnosis of the disease, but if desired is readily carried out by substituting absorbed antisera for the bivalent diagnostic serum.

Summary and evaluation

The characterization of *V. cholerae* in terms of the foregoing tests may be summarized as follows:

sucrose	mannose	arabinose	cholera-red	Voges-Proskauer	haemolysis
+	+	—	—	—	—

Vibrios conforming to this pattern are usually found to be of serological O group I. Such agglutinable vibrios conform to the definition of *V. cholerae* and the micro-organism may be regarded as identified.

Two deviations from this pattern are encountered with some frequency. First, in an appreciable proportion of cases, perhaps as much as 1%, vibrios are isolated from patients with clinically typical cholera in practically pure culture which may or may not differ culturally from *V. cholerae*, but which do not agglutinate in O group I antiserum. Whether such organisms are etiologically related to the acute diarrhoeal disease or represent contamination in the cholera stool specimen has not been satisfactorily determined.

Secondly, the vibrios isolated may conform in all respects to the characterization of *V. cholerae* with the exception that they are haemolytic. These are the so-called El Tor vibrios of O group I, and the test for haemolytic activity thus assumes primary significance in their differentiation from *V. cholerae*. Such haemolytic forms, because they are frequently present in surface waters, may be met with as contaminants in human stools, most often those of healthy individuals. But they have been found to be the specific etiological agent in acute epidemic diarrhoeal disease, clinically indistinguishable from cholera, in Celebes. Haemolytic vibrios have also been found in India in connexion with acute diarrhoeal disease (Mukherji, 1955). Whether these El Tor vibrios are distinct pathogens differentiable from *V. cholerae* or are atypical variants of the cholera vibrio has not yet been determined.

However this question may eventually be resolved, only those vibrios conforming to the pattern described above are generally regarded as *V. cholerae* and reported as such.

REFERENCES

- Ahuja, M. L. et al. (1950) *Laboratory diagnosis of cholera. Bacteriological procedures.* In: *Wld Hlth Org. techn. Rep. Ser.* **18**, 10
- Ahuja, M. L. et al. (1951) Laboratory diagnosis of cholera. A note on bacteriological procedures. *Indian J. med. Res.* **39**, 135
- Burrows, W. & Pollitzer, R. (1958) Laboratory diagnosis of cholera. *Bull. Wld Hlth. Org.* **18**, 275
- Loghem, J. J. van (1913) Über den Unterschied zwischen Cholera- und El Tor-Vibriolen. *Zbl. Bakt., I Abt. Orig.* **67**, 410

- Maaløe, O. (1955) The international reference preparation for opacity. *Bull. Wld Hlth Org.* **12**, 769
- Mukherji, A. (1955) Hemolytic vibrios in cholera epidemic at Lucknow in 1945. *Indian J. med. Sci.* **9**, 540
- Taylor, J., Pandit, S. R. & Read, W. D. B. (1937) A study of the vibrio group and its relation to cholera. *Indian J. med. Res.* **24**, 931
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