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Please read this bit first

The HPCSA and the Med Tech Society have confirmed that this clinical case study, plus your routine review of your EQA reports from Thistle QA, should be documented as a "Journal Club" activity. This means that you must record those attending for CEU purposes. Thistle will **not** issue a certificate to cover these activities, nor send out "correct" answers to the CEU questions at the end of this case study.

The Thistle QA CEU No is: **MT00025.**

Each attendee should claim **THREE** CEU points for completing this Quality Control Journal Club exercise, and retain a copy of the relevant Thistle QA Participation Certificate as proof of registration on a Thistle QA EQA.

Cycle 20 Organism 1

The causative organism was Salmonella.

Salmonella is a Gram-negative facultative rod-shaped bacterium in the same proteobacterial family as *Escherichia coli,* the family *Enterobacteriaceae,* trivially known as "enteric" bacteria. *Salmonella* is nearly as well-studied as *E. coli* from a structural, biochemical and molecular point of view, and as poorly understood as *E. coli* from an ecological point of view. Salmonellae live in the intestinal tracts of warm and cold blooded animals. Some species are ubiquitous. Other species are specifically adapted to a particular host. In humans, *Salmonella* are the cause of two diseases called salmonellosis: enteric fever (typhoid), resulting from bacterial invasion of the bloodstream, and acute gastroenteritis, resulting from a foodborne infection/intoxication.

Salmonella Nomenclature

The genus *Salmonella* is a member of the family *Enterobacteriaceae,* It is composed of bacteria related to each other both phenotypically and genotypically. *Salmonella* DNA base composition is 50-52 mol% G+C, similar to that of *Escherichia, Shigella,* and *Citrobacter.* The bacteria of the genus *Salmonella* are also related to each other by DNA sequence. The genera with DNA most closely related to *Salmonella* are *Escherichia, Shigella,* and *Citrobacter.* Similar relationships were found by numerical taxonomy and 16S ssRNA analysis.

Antigenic Structure

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As with all *Enterobacteriaceae,* the genus *Salmonella* has three kinds of major antigens with diagnostic or identifying applications: somatic, surface, and flagellar.

Somatic (O) or Cell Wall Antigens
Somatic antigens are heat stable and alcohol resistant. Cross-absorption studies individualize a large number of antigenic factors, 67 of which are used for serological identification. O factors labeled with the same number are closely related, although not always antigenically identical.

Surface (Envelope) Antigens
Surface antigens, commonly observed in other genera of enteric bacteria (e.g., *Escherichia coli* and *Klebsiella),* may be found in some *Salmonella* serovars. Surface antigens in *Salmonella* may mask O antigens, and the bacteria will not be agglutinated with O antisera. One specific surface antigen is well known: the Vi antigen. The Vi antigen occurs in only three *Salmonella* serovars (out of about 2,200): Typhi, Paratyphi C, and Dublin. Strains of these three serovars may or may not have the Vi antigen.

Flagellar (H) Antigens
Flagellar antigens are heat-labile proteins. Mixing salmonella cells with flagella-specific antisera gives a characteristic pattern of agglutination (bacteria are loosely attached to each other by their flagella and can be dissociated by shaking). Also, antiflagellar antibodies can immobilize bacteria with corresponding H antigens.

A few *Salmonella enterica* serovars (e.g., Enteritidis, Typhi) produce flagella which always have the same antigenic specificity. Such an H antigen is then called monophasic. Most *Salmonella* serovars, however, can alternatively produce flagella with two different H antigenic specificities. The H antigen is then called diphasic. For example, Typhimurium cells can produce flagella with either antigen i or antigen 1,2. If a clone is derived from a bacterial cell with H antigen i, it will consist of bacteria with i flagellar antigen. However, at a frequency of 10^{-3}- 10^{-5}, bacterial cells with 1,2 flagellar antigen pattern will appear in this clone.

Foodborne *Salmonella* toxic infections are caused by ubiquitous *Salmonella* serovars (e.g., Typhimurium). About 12-24 hours following ingestion of contaminated food (containing a sufficient number of *Salmonella*), symptoms appear (diarrhea, vomiting, fever) and last 2-5 days. Spontaneous cure usually occurs.

Salmonella may be associated with all kinds of food. Contamination of meat (cattle, pigs, goats, chicken, etc.) may originate from animal salmonellosis, but most often it results from contamination of muscles with the intestinal contents during evisceration of animals, washing, and transportation of carcasses. Surface contamination of meat is usually of little consequence, as proper cooking will sterilize it (although handling of contaminated meat may result in contamination of hands, tables, kitchenware, towels, other foods, etc.). However, when contaminated meat is ground, multiplication of *Salmonella* may occur within the ground meat and

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if cooking is superficial, ingestion of this highly contaminated food may produce a *Salmonella* infection. Infection may follow ingestion of any food that supports multiplication of *Salmonella* such as eggs, cream, mayonnaise, creamed foods, etc.), as a large number of ingested salmonellae are needed to give symptoms. Prevention of *Salmonella* toxic infection

relies on avoiding contamination (improvement of hygiene), preventing multiplication of *Salmonella* in food (constant storage of food at 4°C), and use of pasteurized and sterilized milk and milk products. Vegetables and fruits may carry *Salmonella* when contaminated with fertilizers of fecal origin, or when washed with polluted water.

The incidence of food-borne *Salmonella* infection/ toxication remains relatively high in developed countries because of commercially prepared food or ingredients for food. Any contamination of commercially prepared food will result in a large-scale infection. In underdeveloped countries, food-borne *Salmonella* intoxications are less spectacular because of the smaller number of individuals simultaneously infected, but also because the bacteriological diagnosis of *Salmonella* toxic infection may not be available. However, the incidence of *Salmonella* carriage in underdeveloped countries is known to be high.

Salmonella epidemics may occur among infants in pediatric wards. The frequency and gravity of these epidemics are affected by hygienic conditions, malnutrition, and the excessive use of antibiotics that select for multi-resistant strains.

Questions

1. What methods are used to isolate *Salmonella* species?
2. Name the methods used to identify a *Salmonella* to the species?
3. What is an “O” antigen, “H” antigen and a “Vi” antigen?