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28 February, 1992

Dr. Mathew Meselson,
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Dear Mathew,

I have been thinking about the methodology for sorting out the events in Sverdlovsk in 1979. Presently it seems to fall into two separate phases.

Assumptions:

That the data has not been corrupted purposefully or accidentially; obviously we are dependent on our collective experience and on our Russian colleagues to be assured of this.

The data must speak for itself.

There are no a priori presumptions as to the location or locations of sources. Subsequent analyses will use such information.

Anomalies can be expected but they must be minimal.

A certain but small percentage of "pneumonic" anthrax cases will be so defined although in all other respects their origin was food and not an aerosol. **[Mathew, I have a nagging suspicion that a small percentage of enteric anthrax cases have protean 'pneumonic' lesions. But correct me immediately if I am wrong.]**

Part One:

Classification of Autopsy Cases:

1: Define exclusive pathognomonic symptoms and lesions associated with

[a] enteric,
[b] pneumonic,
[c] cutaneous anthrax;
[d] & "None-Of-The-Above".

(NOTA would include hard to categorize forms such as meningitic and oro-pharangeal anthrax; if they occurred in the 1979

epidemic their numbers were trivial. Also when records are incomplete, there must be rejection criteria for such cases.)

2: Renumber all cases using random number tables and remove other person identification from documents. Sort records into new case number order. All being equal we should make every effort to work with the original documents (or xerox copies thereof).

3: Records are to be separately read and classified by two or more qualified pathologists. One must be fluent in Russian. For the final classification, both pathologists must agree if two; if three or more, the majority rules (eg 2/3, 3/4, etc).

[QUESTION ONE: Can we similarly sort the medical cases that did not die?]

[QUESTION TWO: If we cannot have exclusive criteria, can we use a point-system?]

Extraction of Epidemiological Data

The following minimal data will be needed from surviving case records:

1: Full Name

2: Clinic patient-number(s)

3: Randomly assigned study-number

4: Age

5: Sex

6: Home address [-> map reference]

7: Work or school address [-> map reference]

8: Normal/probable time at work/school

9: Anthrax classification [cutaneous, enteric, pneumonic, NOTA]

10: Time and date of onset of clinical signs

11: Date of death

12: Does case-record or related files contain any further information? Y/N

Part Two:

Assessment

The following hypotheses can be considered:

a: Totally pneumonic epidemic.
b: Single "burst" of infective aerosol material from a point source against a miscellaneous background of endemic enteric and cutaneous cases.
c: Two or more point-source aerosol releases similarly within a separate series of enteric and cutaneous cases.
d: Totally cutaneous & enteric and a normal exposure epidemic.

Criteria

a: TOTALLY PNEUMONIC EPIDEMIC.

90% or more of all cases must be classified as pneumonic.
Pneumonic cases must radiate from a hypothetical source or sources. The spatial distribution should be consistant and internally logical (ie we cannot arbitrarily use home addresses for some and work/school addresses for others merely to get clusters or fans of cases).
Because the epidemic lasted for an extended period, if cases cluster in time and space within the epidemic it may be possible to break the series into logical "bursts". Then using Hope-Simpson's technique for calculating the incubation period and the most probable time of exposure, the short incubation periods will be proximate to each other and nearer to the "source", and the long incubation period cases will dispersed further away.
The dispersal must be temporally and spatially in relation to the meteorological conditions of the probable times/dates of exposure (see above for calculation of exposure time); eg it must be downwind and the distribution of cases a function of windspeed, rain/humidity, cloudbase height, and city geometry. However, if "exposure" were quasi-continuous, it may not be possible to invoke Pasquill's rules[1] for particle distribution although he does provide for continuous dissemination.

b: SINGLE "BURST" OF INFECTIVE AEROSOL MATERIAL:

At least 90% of the pneumonic cases must form one cluster in time and space.
Using Hope-Simpson's technique for calculating the incubation period and the most probable time of exposure, the short incubation periods will be proximate to each other and

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1.F. Pasquill (1974) Atmospheric difusion: The dispersion of windborne material from industrial and other sources. Ellis Horwood Ltd. Chichester, UK

nearer to the "source", and preceed the long incubation period cases which will be dispersed further away.

The dispersal must be temporally and spatially in relation to the meteorological conditions of the probable time and date of exposure; eg it must be downwind and the distribution of cases a function of windspeed, rain/humidity, cloudbase height, and city geometry. It will be possible to invoke Pasquill's rules for particle distribution if the meteorological data is adequate.

Any "radial" distribution must be independent from the layout of that part of the city; ie the city plan must be checked to see that it has not forced the artificial appearance of a fan-shaped or "downwind" spread. On the other hand the physical structure of any city will affect airflows and particle deposition/availability.

c: TWO OR MORE POINT-SOURCE AEROSOL RELEASES:

Identical to the single "burst" criteria except that $\geq$ 90% of pneumonic cases will be in separate discrete clusters in time and space.

a/b/c: CHAOTIC/RANDOM PNEUMONIC ANTHRAX

Pneumonic cases without an obvious spatial or temporal pattern characteristic of aerosols or windborne particles.

I.e. When explanations a/b/c above for pneumonic anthrax cannot be invoked, the following hypotheses should be explored:

a: Unrealised aerosol association(s).
- i) With air pollution ... **a long look at your SPOT image with an experienced RS colleague raises the possibility that the plumes might be of industrial origin and maybe from surface activities (eg quarrying, heavy industry).**

b: Non-aerosol B.anthracis source;
- i) Certain percentage of enteric anthrax cases take a 'pneumonic' form, **if this is possible.**
- ii) ???

c: Industrial anthrax;
- i) Bradford disease
- ii) Bonemeal mills.

d: TOTALLY CUTANEOUS & ENTERIC AND A NORMAL EXPOSURE EPIDEMIC.

Virtually all cases are of enteric and cutaneous forms and pneumonic cases are few ($\leq$ 5) and chaotically distributed.

If this hypothesis holds (and even if there were true but limited aerosol spread), it is important to attempt to discover why there were so many enteric cases and so widely distributed. Possible explanations to be tested:

i) Massive multisource exposure to contaminated meats (ie the denominator of exposed individuals was a very large number).

ii) Hyperinfected sausage or other meat product (ie excessive opportunity for sporulation).

iii) Multiple infections involving synergy with other infections or toxic states.

iv) Abrasive diet, eg excessive fibre or sausage filler.

v) Is there an age-resistance mechanism protecting children against enteric anthrax?

My personal opinion on the whole Sverdlovsk "incident" is that I truely do not care whether it was a CBW accidental experiment. What is important is that it is one of, if not, the largest documented human anthrax outbreak in recent history and therefore has to be investigated to discover why it was so large. If it was pneumonic, what contributed to the incidence. And if it were an enteric outbreak, why were so many people affected.

I have tried to be source neutral in setting hypotheses and criteria. We must not be biased by US or Russian "revelations" and especially <u>if</u> there were an aerosol source. The military site is so large that if we come down for an airborne dispersal we may still never know which building (ie ground level or second story release) or chimney (ie high level release) was the origin.

Please let me have your comments.

With best wishes as always,

Yours sincerely,

Martin Hugh-Jones

cc: DH