Laboratory-acquired infections are as old as laboratories themselves. As soon as the culture of microorganisms was introduced, so too was their transfer to laboratory workers.

Early recorded cases
The first recorded laboratory-acquired infection (LAI) was a case of typhoid fever in 1885. Subsequently, there were a further seven recorded LAs between 1887 and 1904:

1887: Brucellosis (from syringe)
1893: Tetanus (from syringe)
1904: Cholera (from syringe)
1907: Brucellosis (from syringe)
1910: Diphtheria (from syringe); Staphylococci (from syringe)
1914: Tuberculosis (from syringe)
1919: Typhoid fever (from syringe)

- The first surveys of LAs (Kidd and Hall 1915) found 58 cases of typhoid between 1885 and 1915, including six deaths. Routes of transmission were aerosols, sharps injuries, contamination of mammalian membranes, ingestion and mouth pipetting.
- American surveys in 1915, 1929 and 1939 found infections with pertussis and Q fever, primarily in microbiologists, following the grinding and centrifuging of yolk sac cultures.

Relative risks of infection between laboratory workers and the general population

<table>
<thead>
<tr>
<th>Organism/disease</th>
<th>Risk/100,000 microbiologists</th>
<th>Risk/100,000 general population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brucellosis</td>
<td>0.01</td>
<td>0.08</td>
</tr>
<tr>
<td>E. coli O157</td>
<td>0.23</td>
<td>0.16</td>
</tr>
<tr>
<td>Methicillin-resistant S. aureus</td>
<td>0.35</td>
<td>0.62</td>
</tr>
<tr>
<td>Salmonellosis</td>
<td>0.5</td>
<td>0.25</td>
</tr>
<tr>
<td>Staphylococci</td>
<td>6.6</td>
<td>6.6</td>
</tr>
</tbody>
</table>

Global interest in LAs!

- Widespread interest in the issues of LAs began in the 1950s.
- Studies by Pike (1955), Salkin (1961) and Grist (1979-1989) revealed the most common LAs in the UK to be tuberculosis (23.5%), hepatitis (20.0%), salmonellosis (27.4%), salmonellosis (11.6%), brucellosis (2.5%) and typhoid (0.2%).

Laboratory-acquired infection and death rates in the USA and Europe, 1951-1970

<table>
<thead>
<tr>
<th>Study/report</th>
<th>Infections (n)</th>
<th>Associated deaths (l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salkin and Pike, 1951</td>
<td>1275</td>
<td>39</td>
</tr>
<tr>
<td>Salkin, 1961</td>
<td>1077</td>
<td>69</td>
</tr>
<tr>
<td>Pike et al., 1965</td>
<td>641</td>
<td>13</td>
</tr>
<tr>
<td>Pike, 1976</td>
<td>3921</td>
<td>164</td>
</tr>
<tr>
<td>Pike, 1978</td>
<td>158</td>
<td>4</td>
</tr>
</tbody>
</table>

- The UK study by Harrington and Shannon (1976) found 21 cases of TB, 20 hepatitis, 45 salmonellosis and one brucellosis.
- Grist’s annual studies of UK LAs between 1979 and 1989 showed 47 cases of TB, 35 hepatitis, 35 salmonellosis, 17 salmonellosis, 4 campylobacter spp., 2 brucellosis, and one case of E. coli O157.
- Pike’s study also listed accident types and their numbers.
- Up to 1990, approximately 129 different organizations have given rise to more than 3500 LAs, resulting in 163 deaths.

Outbreaks that precipitated debate and subsequent legislation

Hepatitis outbreak
- In Edinburgh renal dialysis unit, 40 cases: 26 patients, 12 staff, two home contacts. Even of them died.
- In a London unit: 69 cases including 32 staff.
- The index case in Edinburgh thought to be incubating the infection while undergoing dialysis:
  - Inadequate disinfection of dialysis machine led to spread of the virus to subsequent patients.
  - Likely transmission to staff probably resulted from handling the contaminated machine, needlestick injuries and contamination of mucous membranes by aerosols.

Smallpox outbreak
- In 1973 a science technician who worked with equipment used for smallpox research became ill with what was subsequently diagnosed as the disease:
  - Prior to diagnosis her mother and two visitors also contracted the disease.
  - The technician and her visitors died before the mother survived.
- In 1978 a medical photographer in Birmingham also contracted the infection:
  - Although research into the virus was being carried out nearby, it was not possible to determine the route of transmission.

Acquisition of a laboratory infection
The published literature records five major routes for the acquisition of a laboratory-acquired infection.

Generation of aerosols
Aerosol generation was the most common route described. Surveys show that they may have occurred between 35% and 65% of cases.

Retention and transmission in 1956 recovered 118 viable particles of Vaccinia virus per cubic foot of room air sampled over 10 minutes when a tube containing 50 ml of both culture was broken during the operation of an enlarger.

Accidental inoculation
Needlestick injuries were the most commonly described LAs in the surveys, and accounted for up to 25% of infections.

Mouth pipetting
Mouth pipetting, especially of liquid bacterial cultures, blood and serum, was the case of approximately 15% of LAs in the study by Pike. Mouth pipetting of bacterial cultures was particularly dangerous.

Splashes and splatters
Splashes to the eyes and face generally occurred as the worker was separating the needles while the syringe was still under pressure. Pike’s study in 1978 isolated 177 cases (0.1% of the total number) due to needle and syringe accidents.

Mouth pipetting, especially of liquid bacterial cultures, blood and serum, was the case of approximately 15% of LAs in the study by Pike. Mouth pipetting of bacterial cultures was particularly dangerous.

Eating, drinking and smoking
Once accepted as normal in the laboratory but now forbidden as these habits were implicated in a number of LAs.

Histological samples include cases acquired when food submitted for laboratory examination was wrongly labelled as safe and subsequently came to stool. Similar cases have occurred with milk samples. One case of laboratory-acquired anthrax occurred in a scientist who smoked while working with cultures of the organism.

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