

## Alexander Gordon, puerperal sepsis, and modern theories of infection control—Semmelweis in perspective

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Ignaz Semmelweis, a Hungarian doctor who practised in 19th century Vienna, is widely believed to be the father of modern infection control. He earned this accolade when he showed that puerperal sepsis was contagious and that it could be prevented with adequate hand hygiene. In fact, such ideas had circulated in the medical world for at least a century before Semmelweis' work. Moreover, it is well documented that Alexander Gordon, an obstetrician working in Aberdeen, UK, was the first to prove the contagious nature of puerperal sepsis. He also advocated the need for good hygiene for its prevention in a thesis published in 1795. This work described an epidemic of puerperal sepsis that began in Aberdeen in 1789. Gordon's thesis was reprinted three times in Edinburgh, Philadelphia, and London over the next 55 years, suggesting that Semmelweis (1847) could well have known of his work. Like Semmelweis, Gordon was persecuted for his findings.

### Introduction

Ignaz Semmelweis is commonly accepted as the first person to show the contagious nature of child bed (puerperal) fever and to have shown the benefits of improved hygiene in preventing spread of infection from the post mortem to the patient.<sup>1</sup> Specifically, in 1846, Semmelweis advocated disinfection of hands of attendants, instruments, and dressings and isolation of infected women. However, it is well documented in several texts that others preceded him in this momentous work.<sup>2-5</sup> Most famously Oliver Wendell Holmes published a pamphlet *Puerperal Fever as a Private Pestilence* in 1855 and *The Contagiousness of Puerperal Fever* in 1843,<sup>6</sup> 3 years before Semmelweis. It was not until 1861 that Semmelweis wrote *Die Aetilogie, der Begriff und die Prophylaxis des Kindbettfiebers* (the aetiology, concept, and prophylaxis of childbed fever).<sup>7</sup> This was 66 years after Alexander Gordon of Aberdeen published his observations on an epidemic of puerperal sepsis that started in Aberdeen in 1789 in *A Treatise on the Epidemic Puerperal Fever of Aberdeen*<sup>8</sup> in which he showed the contagiousness of puerperal fever and advised disinfection of the hands and clothes of doctors and midwives.

In fact, Hippocratic writings give a clear description of puerperal fever<sup>5</sup> and the term is first recorded in 1716 by Edward Strother.<sup>5</sup> In 1751, John Burton<sup>9</sup> suggested the disease might be contagious, although just before this in 1746 was the first complete account of an epidemic at the Hotel Dieu, Paris.<sup>5</sup> In 1772, John Leake<sup>10</sup> thought it to be a contagion and the next year Charles White<sup>11</sup> pleaded for cleanliness of surroundings for women who had recently delivered. In 1790, Joseph Clarke recommended isolating patients and disinfecting wards.<sup>12</sup> But it is to Alexander Gordon that the plaudits should really go for conclusively showing the contagious nature of puerperal fever and also how to prevent it.

So this short review will, not for the first time, attempt to set the record straight, following in the footsteps of Lea (1910),<sup>2</sup> Thoms (1928),<sup>3</sup> Colebrook (1956),<sup>4</sup> and Porter (1959),<sup>5</sup> all of whom unequivocally supported Gordon's

claim. Gordon's rightful place as a pioneer of British medicine and modern ideas of infection control has never been acknowledged. Not that everything in Gordon's treatise was correct. His ideas on, for example, blood letting as a treatment were completely wrong and this was realised by many at the time it was published.

### Gordon's treatise on child bed fever

Gordon's treatise was published several times over the succeeding half century, with addenda.<sup>8,13,14</sup> The original 1795 version<sup>8</sup> had seven chapters, the first briefly describing the history and symptoms of puerperal fever. The epidemic started in December, 1789 (which coincidentally was the year the Aberdeen Medico-Chirurgical Society was formed), and seems to have been classic in much of its presentation. Importantly, it did not affect a lying-in (maternity) hospital, only a few midwives and the practice of a single obstetrician (the author).



Figure: A plaque commemorating Alexander Gordon, Aberdeen, UK

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Against traditional thought, he specifically stated that, “the disease was occasioned by a cause very different from the sensible qualities or constitution of the air”. Possibly uniquely among practitioners in Aberdeen at the time, Gordon had first-hand experience of puerperal sepsis before 1792 from his period of training in London. His detailed description of the cases confirms this.

Chapter two, entitled Cases and Dissections describes seven cases, with post mortem findings in three. Concomitant erysipelas is described in one patient. A detailed table of all patients over the 3 years of the epidemic is presented, drawn from Gordon’s journal of the outbreak. This allowed him to trace the spread of the disease from one patient to another.

In the third chapter, Nature and Seat of the Disease, Gordon argues that it is an inflammatory as opposed to a putrid disease, thus needing treatment with bleeding and purging; he claimed successes with this treatment. More correctly, he goes on to confirm the association with erysipelas that had been suggested 40 years earlier by Young and Home in Edinburgh.<sup>5</sup>

Chapter four describes the cause of puerperal sepsis as a “specific contagion or infection” rather than a “noxious constitution of the atmosphere” and is based on the table in chapter two. He gives many examples of himself or midwives carrying infection from one patient to another. His rejection of noxious atmosphere as a cause was on the basis of the absence of disease in geographically related deliveries with no direct contact with the disease. The discovery that he and others were spreading the disease must have posed a great dilemma for Gordon, mitigated perhaps by his belief that he had a cure in bleeding. To his further credit he did not shirk from his duty to make this information public, even at a time when he was already unpopular for his bleeding.

In the fifth and sixth chapters, Gordon describes the success of bleeding and purging. Of the 77 patients treated, only 28 died, proof of his success he claimed. Reasons for the relatively low mortality have been discussed.<sup>12</sup>

The seventh and final chapter is about prevention. “That fresh air and cleanliness are insufficient for the destruction of contagion and that there is no certain antidote but fire and smoke has been demonstrated by the ingenious Dr Lind. The same means ought to be practised for preventing the infection of puerperal fever. The patient’s apparel and bedclothes ought either to be burnt or thoroughly purified; and the nurses and physicians ought carefully to wash themselves and to get their apparel properly fumigated before it be put on again.”

Lewis<sup>15</sup> makes the point that Gordon showed the infectious and transmissible nature of puerperal sepsis through observations whereas his contemporaries were prone to reason and theory without the use of facts. Some might see this as a still common tendency today.

“There have been subjects of great dispute among writers on the puerperal fever. And I hope, that the observations which an extensive experience has enabled

me to make will serve to illustrate the points in dispute ...I am fully persuaded, that if practitioners had observed more and reasoned less, there would have been little dispute, either about the nature or seat of this disease.”<sup>8</sup>

What was Gordon really thinking? How did he interpret what he was finding? Clearly he saw his data pointing to contagion, spread by the midwife: “The midwife who delivered No 1 in the table carried the infection to No 2 the next woman whom she delivered. The physician who attended Nos 1 and 2, carried the infection to Nos 5 and 6, who were delivered by him, and to many others. The midwife who delivered No 3 carried the infection to No 4; from No 24 to Nos 25, 26, and successively, to every woman whom she delivered. The same thing is true of many others, too tedious to be enumerated.”<sup>8</sup> Moreover, further statements confirm this.

“Now it may seem remarkable that the puerperal fever should prevail in the new town and not in the old town of Aberdeen, which is only a mile distant from the former ... But the mystery is explained, when I inform the reader that the midwife, Mrs Jeffries, who had all the practice of that town, was so very fortunate as not to fall in with the infection; otherwise the women whom she delivered would have shared the fate of others”<sup>8</sup> and “What the cause was, shall be mentioned afterwards, in its proper place. For the present I shall only remark that, by observation, I plainly perceived the channel by which it is propagated; and I arrived at the certainty in the matter, that I could venture to foretell what women would be affected with the disease, upon hearing by what midwife they were to be delivered or by what nurse they were to be attended during their lying in [resting in bed for a period after giving birth]; and in almost every instance my prediction was verified.”<sup>8</sup>

In short, Gordon could predict which patients would develop puerperal sepsis by identifying the midwife. This was a major development in epidemiological thinking. Most importantly, he recognised the importance of cleanliness a century before the bacteriological discoveries that would confirm his observations.

### Gordon’s treatise in context

Girolamo Fracastoro (1478–1553) was perhaps the first to suggest a modern form of so-called germ theory.<sup>16</sup> In 1546 he proposed that epidemic diseases were caused by seminaria (seeds) spreading from one person to another by one of three methods: direct contact, contamination of the environment, or through the air. This challenge of the traditional miasma theory had to await the discovery of the microscope for proof. In 1658 and 1676, respectively, using such microscopes, Athanasius Kircher and Antoni van Leeuwenhoek saw such proof, which they described as animalculae. They went on to propose these as the cause of infectious diseases, but it really awaited the discovery of the first pathogenic bacteria some 200 years later for the final proof. In 1877, Robert Koch isolated the

anthrax bacillus and the golden age of bacteriology began. Meanwhile Louis Pasteur (1857) had conclusively shown that spontaneous generation did not happen and Joseph Lister, in 1867,<sup>17</sup> pioneered antiseptic surgery on hearing of Pasteur's experiments.<sup>16</sup>

More than a century earlier, in 1751, Burton seems to have been the first to suggest that puerperal fever might be infectious.<sup>2</sup> According to Porter,<sup>5</sup> 12 epidemics of puerperal fever between 1760 and 1788 led most authors writing during this period to support this view, but most of them believed that the infection originated in the atmosphere, a concept not far removed from that still widely believed by the modern UK population.<sup>18</sup> In 1790, Joseph Clarke<sup>12</sup> came close to the truth when he wrote "this fever derived its origin from local contagion and not anything noxious in the atmosphere". This was based on only three of the four wards of his hospital being affected.

But it was Gordon's observations, probably confirmed by reference to his journal, of the striking association between cases of the disease and earlier contact of himself or the attending midwives with other cases that was crucial. Moreover, he linked puerperal fever not only to erysipelas but also to infection that could result from trauma sustained during the post mortem of an infected patient.

In 1773, White<sup>11</sup> had suggested fresh air and cleanliness of the surroundings as preventive measures because of the putrid atmosphere surrounding a case, but White did not advocate cleanliness of the medical and nursing attendants, nor give any idea that he thought it a contagious illness. From the available published work it is clear that Gordon is the front runner both for showing the mode of transmission and also the method of prevention of puerperal fever, over 50 years before Semmelweis.

Was Semmelweis aware of Gordon's work? Quite possibly, given the free flow of knowledge and extensive travel done in the name of medical education in 19th century Europe and the leading role taken by Scottish medicine at that time (Gordon himself studied in Leiden, Netherlands, and London, UK). It has to be acknowledged however, that there is no record of Gordon's work being translated into German or Hungarian and it has been said that Semmelweis was not widely read. Loudon<sup>19</sup> goes further, claiming that Semmelweis ignored Gordon, perhaps not surprisingly, as he scorned all British work on puerperal sepsis, dismissing the link with erysipelas because it did not tie in with his ideas. Whether one can justify Semmelweis' work as original then is highly debatable in my view, particularly because theories of contagion pertaining to puerperal sepsis had been widely circulating in the preceding century. In Loudon's view however, nobody before Gordon believed puerperal fever was contagious with the possible exceptions of Young and Clark.<sup>12,20</sup>

Within 4 years of publishing his thesis, at the age of 47, Gordon was dead, having been recalled to the navy in 1795 and dying of pulmonary tuberculosis after being invalided out in 1799. His treatise was not neglected

however, and was reprinted at least three times over the next 55 years, in Edinburgh, Philadelphia, and London but it was not until Oliver Wendell Holmes in Boston published *The Contagion of Puerperal Fever*<sup>6</sup> in 1843, quoting Gordon's treatise, that his work gained deserved attention. Holmes advocated that midwives should not do post mortems on septic bodies. In 1855 Holmes's paper was reprinted with the title *Puerperal Fever as a Private Pestilence*.<sup>21</sup> It has to be admitted, however, that it was not until the work of Ignaz Semmelweis and his supporters after 1847, that the concepts first clarified by Gordon became widely accepted.

It does seem that in the early 19th century before Holmes and Semmelweis,<sup>3,22,23</sup> at least within the UK, many obstetricians started appreciating that puerperal fever was contagious, but there is no denying that Holmes and Semmelweis gained the accolade. Perhaps this was because of the brilliance of Holmes's communication skills (he was better known as a poet than as a physician),<sup>24</sup> the tragedy and fanaticism of Semmelweis, or, more likely, that people are generally slow to accept new ideas. Time and place are also factors. Holmes was a professor at Harvard and Semmelweis worked in a renowned medical centre when German pathology was entering a great era. Some of his young contemporaries were the founders of the golden era of bacteriology.<sup>25</sup> But it was Gordon, 80 years before the discovery of pathogenic bacteria and the streptococcus, who laid the epidemiological foundation of this truth. Even in Aberdeen, Gordon is not given due reverence although there is a plaque commemorating his workplace (figure) and also an inscription on an oak tablet in the maternity hospital. Perhaps a new novel celebrating his life will set the record straight.<sup>26</sup> Unfortunately no image of him survives, although the Aberdeen Medico-Chirurgical Society does possess a portrait of his son-in-law who changed his name from Harvey to Gordon in honour of his father-in-law.<sup>27</sup> As with Semmelweis, and no doubt many other scientists ahead of their time, he had to show true courage in proclaiming truth in the face of opposition amounting to persecution.

#### Conflicts of interest

I am the honorary treasurer of the Aberdeen Medico-Chirurgical Society.

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