The Autumn Ghost. How the Battle Against a Polio Epidemic Revolutionized Modern Medical Care

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This interesting and well-written book documents the beginning of modern intensive care, focusing on polio epidemics in Copenhagen, Denmark, in the 1940s through the 1950s. These epidemics left many patients dead from respiratory failure when polio paralyzed the muscles needed for ventilation. Little could be done then to support these patients. Danish physicians and others developed artificial ventilation, now an essential aid for our many critically ill patients. This book tells that story, how artificial ventilation came to become an essential part of today's critical care. It is a striking story set in wartime (World War II), with conflict between the main characters and great tragedy playing out as epidemics of polio continued in the absence of any preventive measures, such as immunization. And, what a lasting good result finally came! Patients and physicians owe a lot to what the polio epidemics eventually brought to patient care.

The author is a critical care anesthesiologist. She is Professor of Anesthesia and Critical Care Medicine at the University of Toronto (Toronto, Canada), and she first learned of Copenhagen's polio epidemics while completing a master's degree in 2001. More reading on polio came to her attention, and then the COVID-19 epidemic began, leading the author to work to document the history of modern critical care. The result is this book. It is set at Copenhagen's Blegdam Hospital, the city's "fever hospital," founded in 1879 to cope with epidemics arriving in the city, brought by those coming to Denmark by sea. The Blegdam was the only hospital for Copenhagen's patients with infectious diseases and so it became the center of the polio epidemics to come. The hospital also became a center for wartime resistance, after Germany invaded Denmark on April 9, 1940.

During World War II, the hospital became a place to escape the Nazi occupation. The large hospital's multiple buildings and many hallways and corridors made hiding and escape easily possible. Thousands of Jewish refugees were sent from the hospital on their way to freedom, crossing by sea in small boats to nearby, neutral Sweden, only 20 miles away. Another route of escape came as the war was ending. Sweden's Red Cross negotiated an evacuation of Danish and Swedish prisoners of war from Nazi prison camps in Northern Germany. This was to be done using a convoy of buses. (The buses were painted white so they would supposedly be protected from Allied bombings; the buses would be vulnerable to bombing because they had to drive far into still-occupied northern Germany to reach the prison camps.) The Blegdam Hospital received the 20,000 liberated but starving and desperately sick evacuees when they arrived in Copenhagen in white buses, and cared for the patients until they were physically able to travel on to their next location—and their freedom.

Polio epidemics were rarely seen in Denmark until the 1940s. Annual epidemics then began, appearing each fall, "The Autumn Ghost" of the book's title. The polio epidemics presented overwhelming clinical problems, the worst problem being respiratory paralysis. At the time, there were few resources for patients needing ventilation, and the Danish medical staff had little experience with artificial ventilation. (The United States had "iron lungs" for ventilating paralyzed polio patients after October 1928. These expensive and complicated negative pressure devices were provided in the United States by the National Foundation for Infantile Paralysis, the United States's charitable organization dedicated to polio.) The Blegdam hospital had only one iron lung and six cuirass ventilators. (Cuirass ventilators had a hard plastic shell covering the patient's chest; this was connected to a device to generate negative pressure under the plastic shell. Air was drawn into the lungs and exhalation was passive.) These were marginal techniques and were inadequate for the overwhelming numeric need as the polio epidemics continued. Up to 50 patients needing ventilation arrived each day.[1]

In July 1942, polio started to reappear, and the numbers were staggering. In 1944, there were 1,019 cases, 219 of these in Copenhagen itself. The Blegdam Hospital's chief physician, Henry Cai Alexander Lassen, struggled with what to do, but he had no experience with polio. Anesthesiologist Bjorn Ibsen, then working at the University Hospital, had spent 1 yr learning to give anesthesia at the Massachusetts General Hospital in Boston and was introduced there to a simple ventilating system, the Waters to-and-fro circuit, often used for operating room anesthesia in the United States at that time. This involved a reservoir bag, a metal canister to hold soda lime to remove the patient's exhaled carbon dioxide, and a nonrebreathing bag (squeezed to provide a patient breath), an in-line humidifier device, and a gas source. After being in Boston, Ibsen returned to Copenhagen's University Hospital as

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an anesthetist. He now had much more experience than the other anesthetists in Copenhagen. He was to lead the way to use this effective and inexpensive positive pressure ventilation technique for those paralyzed in the polio epidemics. Ibsen had, at that point, no practical experience with polio, but he did have anesthesia training. And, he had recently read an article in an obscure American medical journal describing successful use of negative pressure ventilation in polio patients in the United States, during polio epidemics in Los Angeles. Although there was strong reluctance on Lassen's part to try a new way to ventilate polio patients, because of the chance of failure and the risk to his position as Chief Physician, he listened to Ibsen's explanations and finally agreed to try his idea, using a simple nonrebreathing system, the Waters to-and-fro system that he had used in Boston. Given the fact that the hospital only had one iron lung and six cuirass ventilators, there was little choice.

The next day, 12-yr-old Vivi Ebert became the first polio patient to use the more modern and easier-to-use delivery system Ibsen envisioned. She was hospitalized with polio the day after Ibsen and Lassen met about how to cope with the many polio patients needing ventilation. The simple to-and-fro system Ibsen had used while at Massachusetts General Hospital was comparatively simple and inexpensive. Fortunately, Ibsen chose to measure Vivi's ventilation during the trial, not an easy task at the time. He borrowed an oximeter and a Brinkman Carbovisor (both were early devices for measuring respiratory gases and were not in common clinical use then) to measure exhaled carbon dioxide and so was able to know what was happening precisely, and he would be able to show others. Vivi first had a tracheostomy to access her airway, and then manual ventilation began by Ibsen. The measurements of P_{O_2} and P_{CO_2} visually documented inadequate ventilation when that occurred and documented improved ventilation when therapy (for example, suctioning) was done. Boluses of intravenous pentothal provided anesthesia as needed. Vivi had a rocky course that day and night, but Ibsen was able to handle each situation. The worst was an episode of difficult ventilation that Ibsen was able to improve by giving a modest dose of pentothal. This happened at lunch time, when most of the observing physicians were away. They left for lunch fearing Vivi would not survive Ibsen's care. They returned from lunch to find Vivi sleeping, her situation much improved. Three physicians shared nighttime duties that first night. Then, the needs were recruiting helpers to ventilate patients and getting needed supplies for the anesthesia system, such as medical gases and soda lime. As the epidemic went on, up to 70 patients at one time received ventilation by hand. The manpower demands for the hand-ventilated polio cases were staggering. The medical students were supplemented with dental students and other hospital personnel, as needed.

The process of simple hand ventilation during the patients' time of paralysis seemed possible to manage, as the hospital's organization developed. It became clear that some patients would need permanent ventilation, and various long-term facilities were developed for that outside the hospital. Numerous conferences were held, including ones to teach other physicians about care of polio patients. The World Health Organization began courses in Copenhagen on modern anesthesia, and so modern anesthesia and critical care began to spread to more countries. Little Vivi Ebert, the first patient to receive this improved polio care, needed ventilation for the rest of her life. But she lived another 19 yr (!) after her acute polio, taking school examinations, enjoying her family and a well-loved dog, and a brief marriage. What a legacy this brave little girl left!

Anesthesiologists will enjoy this book and will have a better understanding of how critical care medicine developed. What a difference the story of polio in Denmark made, and still makes. The author records this story effectively and briskly; it is a delightful read, well worth spending time on.

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Reference

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