

## Bjørn Ibsen: commemorating his life, 1915–2007

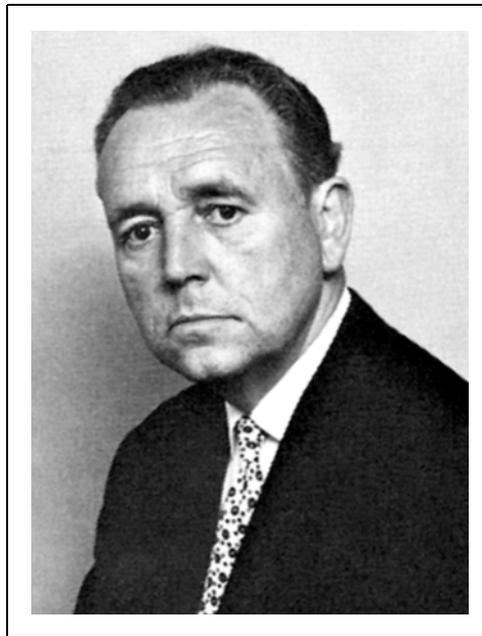
Intensivists, anaesthetists and other health professionals will regret the death on 7 August of Professor, dr. med. Bjørn Aage Ibsen, notable Danish pioneer of modern intensive care medicine, when near to his 92nd birthday. Ibsen is universally recognised as “the father of intensive care” (elsewhere, “the father of intensive therapy as we know it today”<sup>1</sup>). This claim arises from the combination of:

- his remarkable improvements to the treatment of problems in acute paralytic poliomyelitis at Copenhagen, 1952–1953;<sup>2,3</sup> and
- the foundation of the “first intensive care unit in the world”, also at Copenhagen, in 1953.<sup>4</sup>

The first of these achievements took place at the Blegdam Hospital (Blegdamshospital) for communicable diseases, the second at the Municipal Hospital (Kommunehospital).

### Ibsen’s early years

Ibsen was born on 30 August 1915 in Copenhagen and graduated in Medicine from the University there in January 1940 (the Nazis invaded in April of that year). He began training in thoracic surgery but decided, when surgery was starting to seem a doubtful venture for him,<sup>5(p.9)</sup> to transfer to anaesthesia (thoracic surgery had made him “aware of the necessary role anaesthetists played in the surgeons’ performances”). At that time in Denmark, anaesthesia was



not classified as an independent specialty and was considered low in any hierarchical order.<sup>6</sup> Ibsen then went to Professor HK (Harry) Beecher’s Department of Anesthesia at the Massachusetts General Hospital in the United States as an assistant resident from 1 February 1949.<sup>5</sup> Ibsen’s friend Dr John Zorab reported that the year-long course at that hospital provided Ibsen with “an excellent training”.<sup>1</sup>

Ibsen returned to Denmark in 1950, a year during which a Danish “Second Commission’s” enlightened 1950 report recommended that hospitals establish departments of anaesthesia, whose staff “should care for the patients during the operation and postoperatively”.<sup>4</sup> Ibsen

spent 3 years at Copenhagen’s Rigshospital, freelancing as an anaesthetist. During that time, in 1951, he defended his thesis *Necrosis capitis femoris veri et fracturam pertroch anticam*, written when he still wanted to become a surgeon (Dr Preben G Berthelsen, anaesthetist, Holstebro Hospital, Denmark, personal communication).

During a devastating poliomyelitis epidemic in Denmark, Ibsen was called, at the suggestion of Dr Mogens Bjørneboe, senior resident in the medical department (Footnote 1), to a crisis meeting of doctors at the Blegdam on 25 August 1952, set up by head epidemiologist Professor H C A (Henry Cai Alexander) Lassen. After careful study of patients, records and autopsies, Ibsen offered his suggestions.<sup>2,5,6</sup>

### Ibsen at the Blegdam Hospital, 1952–1953

Lassen was initially sceptical of the ideas and proposals offered by Ibsen — whom many at the time would have thought of as “a mere anaesthetist”.<sup>6</sup> Ibsen not only pointed out the physicians’ multiple erroneous interpretations, but made unwanted recommendations — tracheotomy (at that time abandoned there for polio) and artificial ventilation without machinery!<sup>5</sup> Lassen’s ventilator options then comprised one Emerson tank and six (Kifa or Sahlin) cuirass respirators,<sup>7</sup> which had all proved functionally inadequate — and here was a man who had the vision to propose ventilating patients with breathing failure, some-

**Footnote 1.**<sup>6</sup> *An anecdote with a certain charm may account for this. Ger Wackers, who consulted Ibsen when writing about the Ibsen therapeutic revolution, related that, in January 1950, Mrs Ibsen (Doris Kirsten, a trained nurse) and physician Mogens Bjørneboe and his wife were on the same trans-Atlantic ship returning from the United States to Denmark, with Mrs Ibsen explaining the kind of training her husband had been undertaking. Later in Copenhagen, Bjørneboe sought Ibsen’s help for a neonate with tetanus, for supplying not only anaesthesia, but curarisation and manual intermittent positive pressure ventilation through a tracheostomy. The tiny patient died, June 1952, but Bjørneboe found Ibsen’s alternative method of treatment considerably more impressive in controlling the tetanus than had ever been the case previously, when he was using sedation. Accordingly, Bjørneboe suggested to H C A Lassen that an anaesthetist could have a solution for the Blegdam’s polio crisis. (Cheers for informed wives!)*

**Box 1. Ibsen and Copenhagen's 1952–1953 polio epidemic**

- Bjørn Ibsen, although acting out of accord with general understanding at the time, recognised the signs of CO<sub>2</sub> accumulation (learnt earlier from using a “Carbovisor”),<sup>6,9</sup> resulting from underventilation (the “high total CO<sub>2</sub> content” represented acidosis not alkalosis), and distinguished them from what were thought to be “infectious” consequences of poliomyelitis.
- He demonstrated the benefits of tracheotomy and manual intermittent positive pressure ventilation (IPPV) to effect a substantial decrease in mortality rate. He and his colleagues successfully developed a large-scale, organised system of treatment without mechanical ventilators, by utilising medical students, when no more negative pressure (INPV) respirators were available.
- He demonstrated the superiority of large-scale, prolonged, manual IPPV over INPV, which it now replaced.
- By utilising pCO<sub>2</sub> estimations, derived by using Poul Astrup’s new methods of determination, Ibsen obtained an effective guide to optimal ventilatory control.<sup>11</sup>
- He recognised and emphasised the importance of ventilatory intervention before complications such as shock or pulmonary oedema became established and significant.
- He recognised and emphasised the need for stabilisation of a patient before planned, secure interhospital transport by a retrieval team, in ambulance or plane, as well as the benefit of medical staff going out from a central to a peripheral location for a sick patient. “Help should come to the patient, and not the patient to the help.”<sup>5[p.25]</sup>

how without respirators. Lassen reluctantly agreed (was he desperate or prudent?) to allow Ibsen a trial to show his capabilities with a moribund 12-year old, Vivi Ebert<sup>6,8</sup> (her name has been in the public domain). The treatment succeeded, and she lived until 1971.

Ibsen wrote of receiving Lassen’s “enthusiastic encouragement” to begin.<sup>2</sup> After some initial alarms, Ibsen’s management of the girl’s condition by tracheotomy and manual intermittent positive pressure ventilation (IPPV), from a Waters’ to-and-fro bag and (soda-lime packed) canister, spoke for itself, and Lassen became an enthusiastic supporter and collaborator. They solved the manpower problem in “four days”<sup>2,9</sup> by recruiting Copenhagen’s anaesthetists, medical students and some others in sufficient numbers to sustain the large team needed. “A big organisation [was] working after 8 days.”<sup>2</sup> The Blegdam was overwhelmed with patients (see Appendix), and it was hard for everyone concerned, as Ibsen has described;<sup>2</sup> but he was fortunate in having Lassen’s support and organisational skills for the immense effort needed over the next 5 months. The whole story has been well told by Ger Wackers.<sup>6</sup>

Some positive consequences had flowed from the establishment of an international training centre in anaesthesiology in Copenhagen by the World Health Organization only 2 years earlier. Prestigious visiting instructors (Ibsen listed them<sup>5[p.18]</sup>) from the US, United Kingdom and so on, provided the courses. So when the polio epidemic struck, there were “some 20–30 trainees”<sup>2</sup> to help with the 1400–1500 brave students and the nurses (and also to gain experience), as well as the local anaesthetists, including some retired.<sup>9</sup>

In their publications during and after this devastating epidemic, Ibsen<sup>2,5,9</sup> and Lassen<sup>3,7,10</sup> demonstrated to the world the feasibility of successfully treating ventilatory failure in large numbers of polio patients by supplying manual IPPV, whether required for days, weeks or months; while at the same time reducing dramatically the mortality rate from its previously appalling level (see Appendix). Later, a few locally designed machines were constructed,<sup>3[p.68]</sup> (eg, the Bang) and Dr Carl-Gunnar D Engström made his single prototype available at the Blegdam from autumn 1952.<sup>11</sup> The effectiveness and reliability of IPPV (and the supremacy of the Swedish Engström ventilator<sup>11</sup>) was established. Ibsen’s (and Lassen’s) well-publicised lessons were taken up in other parts of Europe, fearful of polio epidemics. Wider production of IPPV machines began, and polio patients with breathing problems were gathered into early respiration units.<sup>12</sup> Ibsen’s achievements during the polio epidemic are summarised in Box 1.

**Further documentation**

The Copenhagen polio story can be read in its ample documentation by the principals, Ibsen and Lassen, while others, especially Ger Wackers<sup>6</sup> and John Severinghaus and colleagues<sup>13</sup> have shone light on further details; and at the 50th anniversary of the end of the epidemic and the foundation of our specialty, this Journal acknowledged Ibsen.<sup>14</sup> In recent years, “Bjørn Ibsen’s Day” (27 August 1952, the day he first applied IPPV to a patient with polio; see Footnote 2<sup>15</sup>) has been revisited in the Scandinavian anaesthesiological literature.<sup>8</sup> The Professor also received fine tributes in English medical writing, from Richard Atkinson in 1997,<sup>16</sup> and Ibsen’s friend Zorab, in the series *The resuscitation greats*, featured in the journal *Resuscitation* in 2003.<sup>1</sup>

Footnote 2. At first, following Lassen’s mixed offerings of dates, I had set “Bjørn Ibsen’s Day” of 27 August 1952 a day earlier.<sup>8</sup> Preben Berthelsen kindly wrote to me after he was able to confirm from “excavating” original hospital records that this day was not 26 August. So a correction to 27 August appeared in my succeeding article.<sup>15</sup>

### An intensive care unit and intensive care medicine

In April 1953, Ibsen was appointed senior resident for anaesthesia to the Department of Surgery I at the Kommune-hospital, and undertook to determine the best postoperative fluid replacement therapy. This enabled him to take charge of the recovery room.<sup>4</sup> His “vast experience gained in polio work”<sup>17</sup> treating respiratory insufficiency at Blegdam had given him the notion of an intensive care unit for treating multiple critical conditions.<sup>5</sup> He converted an existing obser- vation and recovery unit to establish his own truly multidisci- plinary ICU. (“Multidisciplinary” is in the sense of the conditions treated, now medical as well as postsurgical recovery and others, and not as referring to an excess of doctors from multiple specialties — the ICU was “his” unit.) Ibsen’s 1966 article<sup>17</sup> describes its evolution to what he called his “intensive therapy unit” or ITU (see Footnote 3).

Confirmation that Ibsen’s ICU actually was the world’s first comes from fine sleuthing of original records and the medical literature by Drs Preben G Berthelsen and Michael Cronqvist.<sup>4</sup> The unit’s first patient on 21 December 1953 was non-surgical, transferred from a medical ward. Ibsen thereby started and established the practice of modern intensive care medicine<sup>17</sup>[p.285],<sup>18</sup>[p.268] — although he was not using that term — starting “little by little”,<sup>4</sup>[p.1192] with one patient at the end of 1953, 13 in 1954, and 120 by 1957.<sup>4</sup> The firm line he took over admissions can be seen in the conditions he established for entry to his ICU. He required a statement written in the patient’s records by the referring doctor that the patient was moribund before he or she would be admitted. “I wanted to make sure that if the patient recovered, it would be recognised to be due to our treatment, and that if he did not recover, our treatment would not be blamed.”<sup>5</sup>[p.33]

By 1957, Ibsen was able to report<sup>17</sup>[p.285-6] on his first 4 years of ICU experience, presenting the notion, “let us use the cooperation of anaesthetists who can form a pool of trained personnel and the respirator centers for treatment of any respiratory insufficiency” from “all conditions”, “to stimulate further the development of intensive therapy units in general medicine and surgery”. Then a year later, when his department of anaesthesiology attained beds of

**Footnote 3.** Ibsen described<sup>17</sup>[p.284-5] a transition of ideas from:

- the hospital’s polio-specialised unit; to
- a rostered pool of anaesthetists for clinical crises in Copenhagen, available on standby, with equipment; to
- (after successful management of two tetanus patients with sedation–curarisation–IPPV at different sites in the hospital), the installation of a tetanus room, with four successive patients similarly treated, 1953; to
- the first ITU (intensive therapy unit), one “combined with the service from a conventional recovery room”, inaugurated at the Kommune-hospital in Copenhagen on 1 August 1953; to
- the first medical patient treated there from 21 December 1953.<sup>4</sup>

### Box 2. Ibsen and the foundation of intensive care medicine

- Ibsen revolutionised the management of respiratory insufficiency in acute poliomyelitis.
- He applied basic anaesthetic principles of care, to maintain the vital functions of critically ill patients.
- He suggested the notion of the intensive care unit, originating from respiration units, for the critically ill, then in 1953 established Denmark’s first ICU at Copenhagen’s Kommunehospital, where he was in charge of care of his own patients.
- He established working rules for safe practice during procedures, such as:
  - avoiding any period of anoxia;
  - preceding tracheotomy with endotracheal intubation;
  - assisting inadequate ventilation or performing intermittent positive pressure ventilation; and
  - treating shock with intravenous fluids or vasopressors (soon, vasodilators).<sup>2</sup>
- In establishing the legitimacy of anaesthetists working in such sites (“The anaesthetist came out of the operating room”<sup>21</sup>), he promoted the concept of the anaesthetist–intensivist. This led to the concept of the dedicated intensivist.
- He established the concept of intervention at the right time for patients whose condition is deteriorating.
- He developed the concept of organising safe transport to the ICU from outside and from distant hospitals, as well as intra-hospital. He established retrieval teams.

its own, to publish details, in his “epoch making”<sup>4</sup> article (written with Norwegian anaesthetist, Tone Dahl Kvittengen [1911–2001]),<sup>19</sup> of the treatment of 258 patients, of whom 165 survived. Its title translates from the Danish as *The work in an anaesthesiologic observation unit* — which was at the Kommunehospital. (Berthelsen and Cronqvist recently provided us with an English summary<sup>4</sup>). Eight years later, Ibsen listed, this time in English, the wide spectrum of conditions and their associated problems managed in his ITU.<sup>17</sup> Also in 1966, he described various ICU issues,<sup>17</sup> such as aspects of leadership and anaesthetists’ direct responsibility for patient care in ICUs; control of bacteriological problems; air-conditioning and humidification; heat regulation and fluid therapy; and record-keeping. Reflecting on his unit’s “intensive therapy” in a 2002 interview, he said, “What we did was just to use the principles and techniques, which served us so well in the operating theatre, also on patients with medical diseases”.<sup>4</sup>[p.1190]

Ibsen enlarged on his intensive therapy experience in his 60th birthday, 1975 supplement to the *Acta anaesthesiologica Scandinavica*, entitled *Personal experiences in Copenhagen during the past 25 years*.<sup>5</sup> That work provides an engaging and fascinating retrospective. At the first International Symposium on the History of Anaesthesia in 1982,<sup>20</sup> he was still discussing the vasodilating “lytic cocktail” for

**Box 3. Ibsen's general achievements**

- Founded the world's first truly multidisciplinary intensive care unit.
- Laid the foundation of intensive care medicine ("intensive therapy").
- Established the superiority of positive pressure mechanical ventilation, initially with acute poliomyelitis.
- Advocated early, preventive intervention in patients whose condition is deteriorating.
- Established the principles for safe transportation of the critically ill.
- Initiated vasodilator instead of vasopressor therapy in shock.
- Produced the first article (in Danish) on intensive therapy, 1958.
- Increased the reputation of anaesthetists.<sup>4</sup>

shock — he first used chlorpromazine in patients with shock in 1955.<sup>17</sup> Zorab described how, with organisational changes impending at the Kommunehospital "about 1975", Ibsen moved to exploring the field of chronic pain, to develop and make pain clinics the major interest in his final years of clinical work.<sup>1</sup> His achievements in the foundation of intensive care are summarised in Box 2.

**Ibsen's priority rights**

In relation to his priority rights as "father of intensive care", Ibsen wrote generously of the contributions of others. He acknowledged repeatedly that "it was in the library" that he had first read an account (from Los Angeles, by Albert Bower, V Ray Bennett and colleagues<sup>22,23</sup>) of using positive pressure ventilation for polio. Not many others could have done that, as the methods of Bower and colleagues were evidently not adopted elsewhere in the United States at the time, whereas Ibsen and Lassen's propagandising of the merits of manual IPPV produced immediate imitation. Ibsen wrote to the Americans asking for a copy of their article; and when the epidemic in Copenhagen was reaching crisis point, he tried to interest Lassen in their approach of supplying IPPV for the ventilatory problem.

In 1966, Ibsen referred back to Lassen's polio unit thus: "The second intensive therapy unit was now [1952] in use in Denmark — the first being the one for barbiturate

poisoning cases — but this one had the same limitation: only one type of disease was being treated"<sup>17</sup>[p.284] (see Footnote 4). He put his own multidisciplinary unit into perspective a page later: "The first intensive therapy unit not concerned with polio or barbiturate poisoning was inaugurated at the Kommune-hospital in Copenhagen August 1, 1953, combined with service from a conventional recovery room". (Note that the ICU's first patient was admitted on 21 December 1953.<sup>4</sup>)

**Honours**

Ibsen received many honours in recognition of his outstanding contributions to medical practice. He was an honorary member of the Faculty of Anaesthetists of the Royal College of Surgeons (Dublin), the European Association for Intensive Care, the European Association for Resuscitation, the Danish Association of Anaesthetists, and the Scandinavian Society of Anaesthesia and Intensive Care (Dr Preben G Berthelsen, personal communication).

From 1 April 1954, Ibsen was Chief of the Department of Anaesthesiology at Kommunehospital and, from 1971, Professor of Anaesthesiology, University of Copenhagen.<sup>4</sup>

**In conclusion**

As the history of intensive care medicine grows longer, it is catching up with the life spans of the pioneers. To name just two, Australasia's Matt Spence died in 1992, and Peter Safar in 2003, but now the original pioneer of modern intensive care medicine has finally joined them. We in Australasia regret that, and offer our condolences to his family. Denmark and Scandinavia must be proud of Ibsen's lifetime achievements (Box 3); many people owe their lives to the changes he introduced.

**Acknowledgements**

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**Footnote 4.** *Yes, but the type of polio disease required more than "limited" management of hypercarbia and hypoxia by effective respiratory support. Other features of the disease included shock, "cerebralia"<sup>7</sup>[p.164] and devastating cerebral destruction,<sup>15</sup> gastric atonia, paralytic ileus, pulmonary oedema, azotaemia and hyperthermia.<sup>3,7</sup>*

**Appendix. Features of critically ill patients at the Blegdam Hospital during the Danish poliomyelitis epidemic, 1952–1953<sup>3\*</sup>**

**The epidemic initially<sup>3,10</sup>**

Europe's worst epidemic ever, with over 3000 patients at the Blegdam Hospital — "a state of war".<sup>10</sup>

4 July–3 December 1952: 2722 polio admissions,<sup>3,10</sup> 866 with paralysis, and 1856 without.<sup>10</sup>

7 July–2 March 1953: 3722 (this time, many adults) admitted with polio.<sup>9</sup>

Lassen started with one Emerson negative pressure ventilation (NPV) respirator and six cuirasses.<sup>3</sup>

From epidemic's beginning to 26 August: 31 needed special treatment<sup>10</sup>, Table 3 (compare 349 total for the whole epidemic<sup>9</sup>).

After around 6 weeks of epidemic, 27 of 31 NPV patients, or 87%, died (19, or 70%, within 3 days of arrival<sup>3,10</sup>).

25 August 1952: Ibsen attended a crisis meeting.<sup>2</sup>

27 August 1952: day of Bjørn Ibsen's first intervention.<sup>15</sup>

**Staff organisation**

Three hospital floors, each with 35 patients (mostly in single rooms),<sup>2(p.73)</sup> directed by a minimum of 40 anaesthetically trained assistant doctors provided each day for the full 24 hours, from Copenhagen's four largest hospitals seriatim.<sup>9,24</sup>

A senior anaesthetist gave the anaesthetics for tracheotomy and supervised the assistants who were guiding medical students "for the full period".<sup>9</sup>

Eventually around 1400 (or 1500<sup>6</sup>) students were mobilised to provide manual intermittent positive pressure ventilation (IPPV), for a total of 165 000 hours.<sup>6,4</sup>

Six hundred trained nurses needed.

The students worked in 6-hour shifts, with four shifts daily, until sufficient "mechanical students" (ie, ventilatory machines) became available.<sup>6(p.427-8)</sup>

Close cooperation of all physicians (working 12–16 hours daily, for months), 2-hour daily meetings and numerous discussions.

Over 4 months, there were 1500 emergency calls to otologists during the hours 19:00–07:00 alone.<sup>9</sup>

Thirty-four physiotherapists during the epidemic.<sup>9</sup>

**Patients and treatment**

28 August–3 September: 335 admissions (around 50 per day),<sup>3</sup> with the epidemic peaking around 1 September.<sup>6(p.427),10(p.37-8)</sup>

During several weeks, 40–70 patients needed bag-ventilation from about 200 medical students daily.<sup>10</sup>

On a single day after the first 900 admissions, 75 patients were receiving manual IPPV,<sup>9</sup> which required:

- 250 medical students, 260 bedside nurses "from outside",<sup>9</sup> and 27 workers as required to change
- 250 cylinders with 10 gallons (45.5 L) O<sub>2</sub><sup>9</sup> for IPPV, with O<sub>2</sub> and N<sub>2</sub> in a 50 : 50 ratio.<sup>9</sup>

(30 shillings was paid for a medical student for 8 hours; or for a day's mixed gases; or for a day's soda-lime.<sup>10</sup>)

Of total patients: critical, 349;<sup>7,9</sup> respiratory failure, 333; tracheotomy, around 267 (and 42% died); and ventilated, around 277 (and 42% died).<sup>8,15</sup> (Over 75 were brought in from localities outside the Blegdam's usual area.<sup>10</sup>)

Some patients needed bag-ventilation for over 3 months.

**Mortality**

"A great proportion of the patients treated by tracheotomy and bag ventilation were in a very bad state on admission".<sup>10</sup> (4 were "DOA".)

26 August–6 November: 250 needed tracheotomy and manual IPPV (100 died, including 5 admitted moribund, who died forthwith).<sup>10(p.40)</sup>

With the associated treatment, this reduction in mortality from 87% to 40% represented 100 lives saved.<sup>10[table3]</sup>

26 August–6 November: 47% mortality rate for 150 consecutive patients treated by tracheotomy and manual IPPV.<sup>10</sup>

6 November–6 December: 31 admissions, death rate of 23%.<sup>10(p.40)</sup>

Overall, mortality decreased from 87% to 42%, but was down to 11% for the epidemic's last 18 patients,<sup>15</sup> despite "constant severity of the cases throughout the whole epidemic period".<sup>7(p.158)</sup>

**Other participants**

As well as HCA Lassen, Ibsen particularly acknowledged Poul Astrup, Mogens Bjørneboe, Erik Wainø Andersen and Frits Neukirch.

\* Variations in numbers are discussed in references 8, 14 and 15.

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