

The Legacy of the Anaesthesia 'Events' at Pearl Harbor, 7th December 1941.

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'For the past 73 years, since the Japanese military attack on the US naval base at Pearl Harbor on 7th December, 1941, most anaesthetists have been taught that the sodium thiopentone (Pentothal®) anaesthesia caused hundreds of perioperative deaths in the 1178 casualties of the battle'.¹ It is believed that about 1,000 of these required emergency surgery in the subsequent 24 - 48 hours.

When I was a medical student attached to the Anaesthesia Department at the Royal Adelaide Hospital in 1971, my consultant said to me:

"Lad, if you go on to do Anaesthesia, you must use this thiopentone with great care and diligence because the Yanks killed more of their own at Pearl Harbor than did the Japanese in their attack in 1941."

When I asked how did he know this, he replied that he was told that when he was a trainee in Belfast

in 1949! That story has been told to thousands of anaesthesia trainees all over the world, including the USA, and is succinctly reviewed by Prof. Selma Calmes in the video presentation 'Pentothal and Pearl Harbor' on-line at the Wood Library-Museum website.²

In 1992, the year after the 50th anniversary of the attack, Dr Frank Bennetts, a consultant anaesthetist in Kent, and an active member of the History of Anaesthesia Society, published in the U.S. Anesthesia History Association's Newsletter a review of thiopentone anaesthesia since its introduction into specialist practice in 1934, entitled: 'Thiopentone, Chicago to Pearl Harbor'³, which included much detail about its use at Pearl Harbor.

'Then, in 1995, after reviewing US military documents released under the US Freedom of Information Act (1946), he published what has become the most definitive paper on the Pearl Harbor anaesthesia events.⁴ That paper acknowledged that censorship by the US military of the extent of thiopentone morbidity/mortality was possible, because no actual numbers of such complications have been revealed by the military authorities, notwithstanding that few detailed records of anaesthesia were kept. The only official figures cited were from one civilian-military hospital, the Tripler Army Hospital, which is about five miles from Pearl and which employed some civilian surgeons whose anecdotes and accounts were not subject to strict military policy.'¹

Bennetts concluded: "...it is clear that the rumoured death rate from this cause has been greatly exaggerated." I suspect that the death rate which Dr Bennetts was referring to, was the anecdotal one

alluded to me in 1971, and which was also told to him as cited in his 1992 paper.³

I disagree with his conclusion that the *rumoured* death rate was greatly exaggerated, but accept the fact that the actual number of true anaesthetic deaths will never be known because few, if any, detailed records were kept, and because there was no clearly defined classification of anaesthetic deaths, as there is today. Many such World War II (WW2) fatalities were classified as 'having died of their wounds', or 'during surgery'.⁵

In 1941, the hazards of using thiopentone in severely shocked patients were unknown to the military nurse anesthetists and others who were responsible for administering anaesthesia at Pearl Harbor. 'Cardiovascular collapse and respiratory arrest together with a shortage of oxygen supplies, lack of resuscitative skills and equipment and knowledge of thiopentone's pharmacology and dosage, along with a dearth – possibly none – of trained, skilled, physician anaesthetists clearly resulted in several tragedies'.¹ But just exactly how many will never be known. 'Some spinal anaesthetics too contributed to the peri-operative mortality, and the available local anaesthetics, procaine and tetracaine, were quickly restricted to infiltration only – mainly in burns patients'.¹

A year after Pearl Harbor, Admiral Gordon Taylor RN, said: "*Spinal anesthesia is the ideal form of euthanasia in war surgery*"; and Dr MJ Halford, a senior surgeon at Pearl Harbor, added: "...and let it be said that intravenous anesthesia is (also) an ideal method of euthanasia."⁵ That paper in *Anesthesiology* in January 1943 prompted a four page Editorial entitled: 'The question of intravenous anesthesia in war surgery'.⁶ The 'question' discussed the overall safety of thiopentone and outlined in great detail the extreme dangers it heralded in shocked patients, and under conditions of war. The 'warnings' were based on '...partial reports of military experience...' and not on '...thorough trial under both laboratory and clinical conditions in civil circumstances...' Moreover, it is cited that the 'question' required discussion and an answer because '... it had occupied the minds of physicians and surgeons since the attack on Pearl Harbor, and partly as a result of the happenings there.' Other papers in that and in many other 1940s issues of *Anesthesiology* and in many other journals during 1942-43 carried similar messages. But nowhere are those 'happenings' quantified.

It is not surprising therefore that during (and after) that *infamous* day in 1941 the nurse anesthetists, surgeons and others responsible for anaesthesia quickly reverted to using and requesting 'drip ether'

as the preferred anaesthetic technique. A review of endotracheal anaesthesia techniques used in the US military in 1945 in Italy cited only 10% included thiopentone.⁷ Indeed, even in 1950, in the Korean war, the US Military's nurse anesthetists continued to use 'drip-ether', as depicted in some 5 episodes of the TV series *M*A*S*H*.⁸ In that war too, US anaesthesia equipment was not standardised and could not be shared with the British and other allied medical teams.⁹ That is not to say that thiopentone was not used in small intermittent doses, but its use in full induction-doses was unlikely because after Pearl Harbor, the hazards of its use in shocked patients were quickly appreciated by physician anaesthetists, who began to use smaller, intermittent doses.^{6,7,10} Moreover, after Pearl Harbor, the Mayo Clinic's use of thiopentone declined markedly, whereas the drug's popularity continued to increase in UK hospitals and throughout the world as more physicians took up anaesthesia as part of their medical practice. (See Table 1.)

Table 1. Prevalence of thiopentone usage 1941-1951. From Dundee JW (Ed). *Thiopentone and other thiobarbiturates*. Edinburgh: E.S Livingstone, 1956;10-12.

	Mayo Clinic	UK Hospitals
End 1941	30%	9.5%
End WW2	24%	25%
End 1951	52%	76%

This decline at the Mayo Clinic is very significant because it was in the early 1930s that the US anesthesiologists Prof. Ralph Waters in Wisconsin and Dr John Lundy at the Mayo Clinic in Rochester US who initially researched thiopentone and introduced it into clinical practice.¹² They demonstrated clearly thiopentone's many advantages over ether and other thiobarbiturates.^{11,12,13}

Ironically, Prof. John Dundee, in his 1956 *Thiopentone and other Thiobarbiturates* textbook and in his other 37 publications on thiopentone, did not comment on this marked decline in its use at the Mayo clinic, whilst the drug's popularity soared elsewhere, especially in Britain where all anaesthesia was administered by doctors.^{11,14}

In 1942, the US National Research Council established an Anesthesia Committee to oversee physician training and to improve anaesthesia in the European Theatre of Operations. This committee, which was chaired by Prof. Ralph Waters also included Prof. Henry Beecher, Drs John Lundy and Ralph Tovell had far-reaching powers to recruit and train doctors as anesthetists for the US Military.^{10,13}

By 1943, this committee had begun to address the lack of 'trained anesthetists' and scarcity of

appropriate equipment such as portable, closed respiratory/ventilation systems which were major contributors to anaesthetic mortality and morbidity.^{3,7,14,19} The committee dragooned many young US doctors into three-month training courses, some of which were conducted in Britain for Allied Forces under the auspices of Prof. Macintosh and other British colleagues.¹⁰

It is important to appreciate that in 1941 Anaesthesiology was not recognised as a medical discipline in the Surgeon General's Office in the US military, and had minimal medical status throughout the US until after Pearl Harbor and WW2.^{15,16,17} Rather, nurse anesthetists were employed almost exclusively at Pearl Harbor, although some doctors with some anaesthesia experience were involved. Official training of nurse anesthetists began only after the foundation of the National Association of Nurse Anesthetists in 1931 and was only really standardised and recognised in the late 1940s.^{18,19}

The American Board of Anesthesiology was constituted in 1939 and, by the end of 1941, there were only about 100 certified, physician anesthetists in the whole of the US, with less than 50 in the military, whereas in England, the Diploma of Anaesthetics of the Royal Colleges of Surgeons and Physicians had begun in 1934, and anaesthesia was practised only by doctors.^a Undoubtedly, these significant differences between the US and Britain, and other countries, in the status, recruitment and training of personnel responsible for anaesthesia services contributed to the 'anaesthesia events' at Pearl Harbor.^a

In the US, back in 1937, Prof. Ralph Waters, who was one of the principal educators of nurse anesthetists, had attempted to convince surgeons of this long before Pearl Harbor, when he wrote:

"Anesthesia received little aid or stimulation by surgeons who frowned upon medical men to improve the status of anesthesia. This attitude placed anesthesia into the hands of young assistants and nurses or technicians."¹⁶

Halford, in his classic paper in *Anesthesiology* (1943), just a year after Pearl Harbor, stated that the army needed 'anesthetists' and appealed to any 'trained/qualified men' to apply for a commission and join surgical teams.⁵ That appeal, in *Anesthesiology* was clearly directed at doctors – not nurses.

Today, in the US, specialist physician anaesthetists are referred to as 'anesthesiologists', whilst nurses and others who are not specialists are 'anesthetists'.

(The term 'anesthesiologist' denoting a physician anaesthetist, came into common use only in the 1940s, when more doctors adopted Anaesthesiology as a career;^{17,20,21} whereas, in most of the rest of the world, physicians had always been the principal practitioners of anaesthesia.) During and after the War many doctors concurred with Halford's plea and within a few years appropriate anaesthetic training courses were established, and in due course, many of those so trained gained specialist/consultant recognition and status.^{13,22,23,24}

These WW2 tragedies, especially those at Pearl Harbor, were a wake-up call for surgeons and the medical profession generally throughout the world to improve Anaesthesia. Finally, in the US, it had become clear that no longer was it appropriate for any junior doctor, nurse or technician to administer 'sophisticated' anaesthesia for many surgeries, and especially to critically-ill patients.¹ This had been known for many years in thoracic and neurosurgery, at specialist clinics such as the Mayo, and in many other countries.^{16,21,22,23} Nevertheless, today some 17 nations have large contingents of nurse anesthetists, who, in some regions still practise independently.

As the WW2 progressed, portable, closed-system breathing circuits enabling the safe administration of ether with either oxygen ± air ± nitrous oxide ± ether using spontaneous or assisted ventilation became more widely available. The types of apparatus used are well illustrated in the WW2 review documents published by the US Army Medical Department.²⁴

Through the 1940s and after WW2, it was quickly recognised that the profession required appropriately trained anaesthetists with the knowledge and skills to use such drugs as thiopentone and the sophisticated equipment developed, especially by the British. The Royal Colleges of Surgeons established Faculties of Anaesthetists, and universities in Australia soon introduced post-graduate medical diplomas in Anaesthesia, following the example of the 1934 D.A. in England.

Specialist recognition was enhanced throughout the developed world, in the British Empire and especially in Britain by the establishment of the National Health Service in 1948. Until then most practising anaesthetists were general practitioners, many of whom had gained a post-graduate diploma – the D.A. But by the mid 1950s, once Anaesthesia had been recognised as a medical speciality, education, research and development progressed rapidly, and examinations for Fellowship of the Faculties, not just Membership, began in 1953 as outlined in Table 2.

^a Smith Bradley E. Personal Communication. March 2014

Table 2* 'Significant Developments in Anaesthesiology after Pearl Harbor.'

Education and Specialist recognition:

- 1946 Journal: Anaesthesia
(the eighth Anaesthesia journal)
- 1947 Diploma of Anaesthetics Course, University of Sydney
- 1948 Faculty of Anaesthetists, Royal College of Surgeons, England.

(170 Fellows elected – some from Australia)

Diploma Courses, FARCS England and the University of Melbourne.

National Health Service, Britain.
- 1952 Faculty of Anaesthetists Royal Australasian College of Surgeons
- 1953 Faculty of Anaesthetists Royal College of Surgeons, Ireland Fellowship of FARCS Examination.

Drugs, Equipment and Techniques:

- 1941 Trilene®; Caudal epidurals
- 1942 Curare (purified d-Tubocurarine); Carlen's Tube
- 1943 Macintosh laryngoscope
- 1945 Tuohy needle and first use of 'ureteric' epidural catheters
- 1947 'Balanced' anaesthesia with Pethidine
- 1948 Lignocaine; Methadone; 'Copper Kettle' Vapouriser
- 1949 Scoline®; Apgar Score
- 1950 Hypothermia (Cardiac & Neurosurgery advances)
- 1952 IPPV with bag ventilators & ETT
- 1954 Mapleson breathing systems; Halothane

* Adapted from Table 1.1

Following the British model, university and teaching hospitals in Australasia began to establish teaching departments of anaesthesia in the 1950s, whose roles included resuscitation and critical care, soon to be known as Intensive

Care, which, along with Emergency and Pain Medicine subsequently became specialities in their own right. These specialities began as Faculties within Anaesthesia, just as Anaesthesia itself had begun as a Faculty within Surgery.¹¹

Having reviewed more than 100 publications by surgeons and others in the years following WW2, and visiting and corresponding with many colleagues and others in the US, I am convinced that the thiopentone mortality rate was considerably higher at Pearl Harbor than the 'official' WW2 rate of 1:450 cited in a review of casualties published by Beecher in 1955.¹⁹ That rate included similar anaesthetic mortalities from many other theatres of the war, including Italy and North Africa, and, arguably, was one of the first attempts to accurately define and classify anaesthetic mortality.^{19,20}

During a visit to Pearl Harbor and the USS Arizona Memorial in November 2014, I met with two of the nine surviving US Navy veterans, neither of whom could tell me anything about any anaesthesia 'events', except that one of them, when I asked if he had had 'the ether' when he had shrapnel removed from his head, said: "No. I had an injection." Then he pointed to his right cubital fossa. He said all went well with the surgery, but the next day the surgeon told him he had 'died' during the operation, but that they had resuscitated him. Thus he had received an intravenous anaesthetic, almost certainly thiopentone, but had suffered no sequelae.

'In summary, the significance and legacy of the anaesthetic events at Pearl Harbor were that surgeons, the medical profession generally, and health authorities, recognised the need for appropriately trained and skilled, specialist practitioners of anaesthesia. Today's modern speciality of Anaesthesia, or Anaesthesiology, as I suggest we should refer to it, was born soon after Pearl Harbor and WW2, and the 'Ether Century' began to expire, although ether did continue to be used into the 1970s for many simpler surgeries in less developed centres, principally by GP anaesthetists.¹¹

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Note: Many other references, communications and sources of accounts of events at Pearl Harbor reviewed for this presentation, but not cited, are available on request to the author.

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