



Research article

Deaths associated with GA for dentistry 1948 – 2016: the evolution of a policy for general anaesthesia (GA) for dental treatment



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ABSTRACT

Background: Following the inception of the National Health Service in 1948 dental treatment under General Anaesthesia (GA) became easily available. An unexpected consequence of this was a disconcerting number of deaths associated with GA. Over the decades since 1948 there have been a number of specialist medical society, royal college, and government working parties deliberating on the appropriateness of GA being conducted in general dental practice and community dental practice.

Methods: The figures for the number of general anaesthetics per annum in England and Wales were obtained from the general dental services board, the community dental service, and records from hospital inpatient episodes. The number of deaths per annum were obtained from coroners' enquiries and dental protection societies.

Findings: Prior to 2001 there is a strong correlation between the number of GA's per annum and deaths. Since 2001, when the UK government directed that all GAs for dentistry must be administered in a hospital with Intensive Care facilities the number of deaths per annum has reduced to nil.

Interpretation: The change in the arrangements under which GA for dentistry are administered was coincident with improved training and knowledge of GA for dentistry. This has led to a cessation of deaths associated with GA for dentistry. The incidence rate is now estimated at less than 1 death per 3.5 million GAs.

1. Introduction

The need for pain control in Dentistry has long been an essential part of patient care. The clinical approach to Local Anaesthesia (LA), Conscious Sedation (CS), and General Anaesthesia (GA) for dental procedures in children has recently been refined with the publication of the 5th edition of a standard textbook on Paediatric Dentistry [1]. This, coupled with the recent report from The Royal Colleges of England, Edinburgh, and Glasgow [2] 'The Ibbetson Report' which includes sedation for general dental practice brings to a conclusion, or nearly so, the unjustifiable exposure to risk for patients seeking simple dental treatment using techniques of Local Anaesthesia, General Anaesthesia and/or Conscious Sedation. These relatively recent guidelines present the findings of a systematic review on 'Death related to dental treatment: a systematic review' [3]. It is clear from the summary of the reports in this systematic review that the authors have not considered the significance of the 'Hospital v Outpatient' setting. Of the 43 deaths associated with GA, 2 (4.65%) occur in hospital whilst 41 (95.35%) as an outpatient. This

huge disparity brings to mind the series of reports in relation to general anaesthesia and dentistry that appeared in the UK over the years 1958–2000 [4, 5, 6, 7, 8, 9, 10, 11]. The main theme of the reports is that of patient safety in relation to the operator/anaesthetist and latterly to the general practice compared to hospital practice setting and the circumstances under which the general anaesthetics were administered.

The outcome of over 40 years of clinical research and professional deliberation was that in the UK general anaesthetics could only be administered in a hospital with the critical support of intensive care facilities [11]. This directive combining general hospital facilities with intensive care facilities was to ensure optimum rescue care in the event of an anaesthetic catastrophe. Since the 1st January 2001 it has been a requirement that all general anaesthetics for dentistry in the UK are administered in hospitals with intensive care facilities available if required. Since that date there have been no deaths in England and Wales attributable to a general anaesthetic.

The purpose of this article is to review the figures for deaths associated with general anaesthesia for dentistry in relation to the number of

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general anaesthetics administered per annum in England and Wales during the period 1948 to 2016.

1.1. Historical perspective

General Anaesthesia (GA) was discovered by a dentist in the USA in the mid-19th Century [12]. The technique comprised the administration of Nitrous Oxide (N₂O), usually without Oxygen (O₂). This provided rapid onset of GA as 100% N₂O rapidly achieved loss of consciousness before introducing O₂ once profound anaesthesia ensued, usually during or after dental extractions were performed. Over the early decades of GA for dentistry it was incumbent for the operating dental surgeon to work with great rapidity so that the dental treatment, usually multiple extractions, could be completed in a few minutes. It is understandable that the expression used by dentists and patients alike was to have the ‘smash and grab’ method for extractions. This discovery of GA by a dentist was used over 110 years later as a spurious justification for the continued role of dentists as administrators of GA whilst also undertaking the operative procedure – this claim was made in the face of increasing concern by medically qualified anaesthetists that GA for dentistry should be administered by trained anaesthetists.

The proper basis for training in the administration, maintenance, and recovery from GA is a first degree in medicine.

Over the ensuing years the techniques used for providing GA for dental treatment increased in variety with O₂/N₂O being supplemented with Halothane and eventually with other adjuvants.

The introduction of Intravenous Anaesthesia led to the development of prolonged GA which enabled the dentists to carry out extensive dental treatment in one session often lasting an hour or more. This led to the existence of the Operator-Anaesthetist, a practice promulgated by the Society for the Advancement of Anaesthesia in Dentistry (SAAD). As could have been anticipated this caused great concern amongst medically qualified anaesthetists who argued that the practice of dentistry required the undivided attention of the Dentist, and the administration of the GA required the undivided attention of the anaesthetist. This seemed a simple solution to the concerns of professional colleagues who wanted to bring to a halt the deaths occurring in general dental practice.

The Department of Health of the UK Government, who commissioned the report ‘A Conscious Decision’ published in 2000 extended guidelines to include assessment of the services available in the premises where the general anaesthetics were administered. The result was that from 1st January 2001, all general anaesthetics for dentistry could only be administered in a hospital with intensive care facilities for support [11].

The purpose of this paper is to review the available information for GA for dental treatment and relate those data to the number of deaths per annum associated with the use of GA.

2. Materials and methods

The number of general anaesthetics administered to enable dental treatment were obtained from several sources. Information obtained was the summary data from the statistics published annually by the General Dental Services, the Community Dental Service, and the Hospital Dental Service. The figures for deaths per annum were obtained from the Registrar General at the Office of Population Censuses and Surveys, detailed information from these sources was sought from publications that reported annual figures for deaths [5].

Adjustments to the figures were made by a number of iterations to take account of GAs administered on a private contract basis and also adjusted for deep sedation [13, 14]. The number of GAs since the beginning of 2001 have been obtained from Hospital Episode Statistics [12].

Estimates for death rates were calculated in two ways. First the number of Anaesthetics for each death. Secondly the same figures were used to calculate the number of deaths per million GAs.

3. Results

The number of deaths appear to follow a clear pattern in relation to the Number of GAs up to the cut off at the beginning of the year 2001 (Fig. 1 and Table 1).

In general terms the greater number of deaths in the early 1950's and 1960's are associated with a greater number of general anaesthetics. In later years where the number of GAs reduces the number of deaths also reduces. The Pearson correlation coefficient for this is from 1948 to 2000 is 0.8154.

A distinctive feature of the graph is that from the years 2001–2016 there are no deaths associated with GA for dentistry.

4. Discussion

The acquisition of the data for this report proved to be difficult as there are not systematic or administrative procedures in place for collecting such data. As regards the GA numbers it is fortuitous that the majority of these came from the central records of the Dental Estimates Board in Eastbourne, England. These are considered very reliable as they represent a GA service paid for on an individual basis to each general dental practitioner. Additional figures were provided by the Community Dental Service, with figures also provided by the Hospital Dental Services. For this reason alone, it is reasonable to consider as reliable the estimates for the number of GAs per annum [14].

Several difficulties occur with authors, ourselves included, making adjustments for the proportion of fees paid for sedative procedures which were not differentiated by the Dental Practice Board from GA. Previous

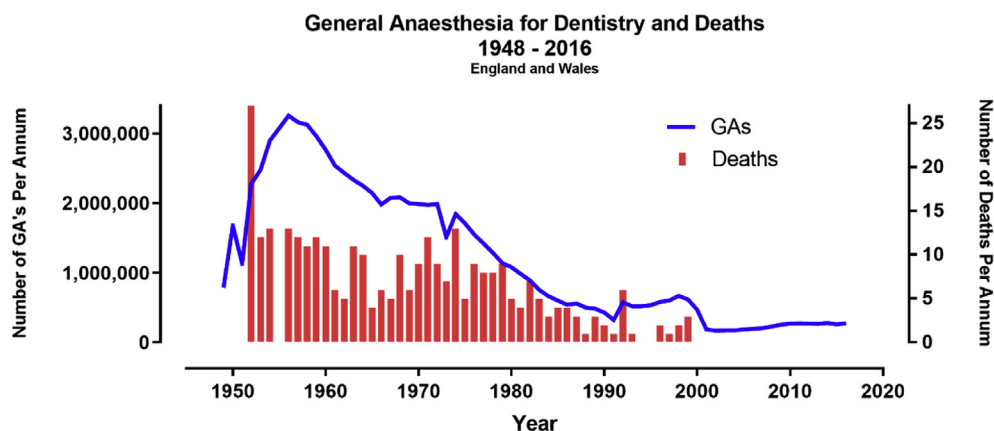


Fig. 1. Total number of General Anaesthetics per annum 1948 to 2016 (left Y axis) plotted as a continuous line with the number of deaths per annum associated with General Anaesthesia (right Y axis) indicated by vertical bars.

Table 1

Death Rate associated with GA for Dentistry presented as the Number of GA's for a single death, and alternatively as the number of deaths per Million GA's. Deaths associated with GA for Dentistry 1948–2017: England and Wales, UK.

Year	GA Total Number	Deaths Total Number	GA's per Death	Deaths per Million GA's
1949	784,436	no data	.	.
1950	1,674,323	no data	.	.
1951	1,133,801	no data	.	.
1952	2,271,863	27	84,143	12
1953	2,478,651	12	206,554	5
1954	2,896,033	13	222,771	4
1955	3,073,696	14	219,550	5
1956	3,256,154	13	250,473	4
1957	3,161,426	12	263,452	4
1958	3,124,219	11	284,020	4
1959	2,962,462	12	246,872	4
1960	2,765,345	11	251,395	4
1961	2,537,872	6	422,979	2
1962	2,432,356	5	486,471	2
1963	2,331,473	11	211,952	5
1964	2,247,323	10	224,732	5
1965	2,143,005	4	535,751	2
1966	1,980,309	6	330,052	3
1967	2,076,301	5	415,260	2
1968	2,082,488	10	208,249	5
1969	1,995,115	6	332,519	3
1970	1,985,412	9	220,601	5
1971	1,972,874	12	164,406	6
1972	1,986,756	9	220,751	5
1973	1,510,931	7	215,847	6
1974	1,843,887	13	141,837	7
1975	1,719,850	5	342,170	3
1976	1,548,835	9	172,093	6
1977	1,420,658	8	177,582	6
1978	1,283,976	8	160,497	6
1979	1,139,147	9	126,572	8
1980	1,079,845	5	215,969	5
1981	982,44	4	245,611	4
1982	889,174	7	127,025	8
1983	752,169	5	150,434	7
1984	662,447	3	220,816	5
1985	599,451	4	149,863	7
1986	541,996	4	135,499	7
1987	559,036	3	186,345	5
1988	501,063	1	501,063	2
1989	485,561	3	161,854	6
1990	429,612	2	214,806	5
1991	321,966	1	321,966	3
1992	575,478	6	95,913	10
1993	520,253	1	520,253	2
1994	519,976	0	.	0
1995	535,026	0	.	0
1996	580,698	2	290,349	3
1997	602,281	1	602,281	2
1998	668,143	2	334,072	3
1999	616,759	3	205,586	5
2000	469,559	0	.	0
2001	186,900	0	.	0
2002	168,632	0	.	0
2003	172,623	0	.	0
2004	172,363	0	.	0
2005	177,657	0	.	0
2006	195,895	0	.	0
2007	204,231	0	.	0
2008	230,402	0	.	0
2009	253,745	0	.	0
2010	269,861	0	.	0
2011	272,221	0	.	0
2012	269,897	0	.	0
2013	264,941	0	.	0
2014	277,901	0	.	0
2015	261,639	0	.	0
2016	273,737	0	.	0

approaches are to enhance the figures for Chair GA by a million or so [4], or 50% [14]. The rationale for these adjustments is not explained so in our work a number of formal iterative processes were followed to improve the estimates for the total number of GAs per annum [4]. These iterations involved taking account of the figures provided in the survey of Anaesthetic Services in 1974 [6]. In summary five (5) different combinations of the data were used and the final iteration was used to compile the figures for Fig. 1. This is our 'informed' estimate for the number of GAs per annum from 1948 to 2001. The figures from 2001 to 2016 are based on the Hospital Admission statistics with total figures for 'Hospital Admissions'. Although the figures for GA's are slightly different from that of Padfield, it is clear that the trends in Fig. 1 and the present paper, are similar. In relation to these estimates is the statement made in 1958 where '...so let us add an estimate of a million per year ...' [4] coupled with '... the total figure is so large that whether one adds a million or a million and a half matters very little.' This thinking raises grave doubts as to the methodological process behind the estimates for mortality statistics provided by those authors at that time.

The same or similar concerns apply to the mortality figure produced in the 'A Conscious Decision Report [2]. Enquiries as to the methodology involved led to the response that it was not possible to provide this information because '... the papers will be contained in a number of different files ...'. Notwithstanding these difficulties the relatively small number of deaths reported are probably reliable as a death in the dental chair or in hospital has a huge significance and is unlikely to be overlooked when counting the total number of deaths occurring in relation to GA for Dentistry. Specific enquires addressed via Freedom of Information legislation, The General Dental Council, and the Dental Defence Organisations did not yield additional figures for deaths.

It is perhaps simplistic to attribute the reduction in the number of deaths solely to the policy change introduced by the UK government in 2000 effective from 1st January 2001. The issue of complications arising during GA induction, maintenance, and recovery is multifactorial. The increase in the numbers of doctors training in general anaesthesia and the vastly improved training in the procedures of GA for dentistry not only reduces the number and nature of the complications but also the efficacy with which they are managed. It is not possible to place any numerical values on this for analysis, but clearly such important changes have had an impact on the management of potentially lethal complications associated with GA for Dentistry and consequently the number of deaths.

A further consideration is that for several decades dental surgeons acted as the Operator/Anaesthetist. This was a matter of considerable controversy but led eventually to its abandonment as an approved procedure culminating in the changes introduced from January 2001. The data in this paper track the number of deaths associated with GA for Dentistry over the prolonged period of policy change introduced by the UK Government.

An important outcome for this review is that since 1 January 2001 to 31 December 2016 there have been 3,465,745 GAs for dentistry administered within the Hospital Service of England and Wales. During this time, it has not been possible to identify a death associated with the administration, maintenance, and recovery from GA for Dental Treatment. Freedom of Information requests were used to try and identify deaths in institutional bodies. None were identified.

This significantly alters the Mortality rate associate with GA for Dentistry to less than 1 in 3.5 million GA's. This startling figure is, as we indicate, is related only to the administration, maintenance and recovery form general anaesthesia for dentistry. Perhaps the GA *alone*, especially using modern techniques used by highly trained anaesthetists, is safer than previously thought.

The decision of the Department of Health in late 2000 to ban the administration of GA for dentistry from community dental practice, private dental practice and general dental practice has proved to be a wise and lifesaving policy. In retrospect it is difficult to see how practitioners who challenged this change of policy could ever have justified what was a misguided view on GA for Dentistry and how it should be

managed. Further, it is of note that the various working parties cumulatively took over 20 years to influence government policy in an effective way.

5. Conclusions

Despite the difficulties of acquiring data on the number of GA's for dentistry administered per annum and difficulties in obtaining the number of deaths per annum, the historical data presented here provide strong support for the policy introduced in 2000, effective from 1 January 2001.

Simply put, GA for dentistry is a safe procedure. Much safer than it was in the first 52 years of The National Health Service in England and Wales.

Declarations

Author contribution statement

Graham Roberts: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Carol Mason: Conceived and designed the experiments; Wrote the paper.

Victoria Lucas: Analyzed and interpreted the data; Wrote the paper.

Sarimah Mohd Mokhtar: Analyzed and interpreted the data.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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