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

Graham J. Roberts a,*, Sarimah M. Mokhtar b, Victoria S. Lucas a, Carol Mason c

a Department of Orthodontics, King’s College London Dental Institute, Floor 25, Tower Wing, Guy’s Campus, London, SE1 9RT, UK
b Department of Paediatric Dentistry, Tuanku Jaafar Hospital Seremban, Negeri Sembilan, Malaysia
c Maxillofacial and Dental Department, Great Ormond Street Hospital for Children, London, WC1N 3JH, UK

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.

ARTICLE INFO

Keywords:
Dental surgery
Dentistry
Evidence-based medicine
Health profession
General anaesthesia
Death
Dentistry

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 anesthesia for dentistry in relation to the number of...
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                 | 219,530        | 5                       |
| 1956 | 3,256,154       | 13                 | 250,479        | 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        | 2                       |
| 1976 | 1,584,835       | 9                  | 172,093        | 6                       |
| 1977 | 1,420,658       | 8                  | 177,582        | 6                       |
| 1978 | 1,283,976       | 8                  | 160,497        | 5                       |
| 1979 | 1,139,147       | 9                  | 126,572        | 5                       |
| 1980 | 1,079,845       | 5                  | 211,952        | 5                       |
| 1981 | 982,44          | 4                  | 245,611        | 4                       |
| 1982 | 889,174         | 7                  | 127,025        | 6                       |
| 1983 | 752,166         | 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        | 7                       |
| 1988 | 501,063         | 1                  | 501,063        | 2                       |
| 1989 | 485,561         | 3                  | 161,854        | 6                       |
| 1990 | 420,612         | 2                  | 214,806        | 5                       |
| 1991 | 321,966         | 1                  | 321,966        | 3                       |
| 1992 | 375,478         | 6                  | 95,913         | 10                      |
| 1993 | 520,253         | 1                  | 520,253        | 2                       |
| 1994 | 519,976         | 0                  | .              | .                       |
| 1995 | 535,026         | 0                  | .              | .                       |
| 1996 | 580,692         | 8                  | 290,349        | 5                       |
| 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                  | .              | .                       |
| 2001 | 186,900         | 0                  | .              | .                       |
| 2002 | 168,632         | 0                  | .              | .                       |
| 2003 | 172,623         | 0                  | .              | .                       |
| 2004 | 172,363         | 0                  | .              | .                       |
| 2005 | 177,657         | 0                  | .              | .                       |
| 2006 | 195,895         | 0                  | .              | .                       |
| 2007 | 204,231         | 0                  | .              | .                       |
| 2008 | 230,402         | 0                  | .              | .                       |
| 2009 | 253,745         | 0                  | .              | .                       |
| 2010 | 269,861         | 0                  | .              | .                       |
| 2011 | 272,221         | 0                  | .              | .                       |
| 2012 | 269,879         | 0                  | .              | .                       |
| 2013 | 264,941         | 0                  | .              | .                       |
| 2014 | 277,901         | 0                  | .              | .                       |
| 2015 | 261,639         | 1                  | 261,639        | 4                       |
| 2016 | 273,727         | 0                  | .              | .                       |
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 20001.

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.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Acknowledgements

The authors are grateful to Dr Michael Coplans and Professor Ivan Curson who, in 1998, provided to GR valuable information on the procedures to be followed when obtaining data from government sources. In addition we acknowledge considerable help from Dr Adrian Padfield who has offered guidance on interpreting the statistics in relation to the number of general anaesthetics and deaths.

References

[1] R. Welbury, M.S. Duggal, M.T. Hosey, Paediatric Dentistry, fifth ed., Oxford University Press, Oxford, 2017.
[2] Standards for Conscious Sedation in the Provision of Dental Care. Report of the Intercollegiate Advisory Committee for Sedation in Dentistry, 2015. ‘The Ibbetson Report’. The Dental Faculties of the Royal Colleges of Surgeons and the Royal College of Anaesthetists.
[3] N.G. Reuter, P.M. Westgate, M. Ingram, C.S. Miller, Death related to dental treatment: a systematic review. Oral surgery, oral medicine, oral pathology, Oral Radiol. 123 (2017) 194-204.
[4] V. Goldman, Deaths under anaesthesia in the dental surgery, Br. Dent. J. 105 (1958) 160–163.
[5] M.P. Coplans, I. Curson, Deaths associated with general dental anaesthesia, Br. Dent. J. 153 (10) (1982) 357–362.
[6] R.C.W. Dinsdale, R. Dixon, Anaesthetic services to dental patients: England and Wales, Br. Dent. J. 144 (1978) 271–279.
[7] Report of the Working Party on Training in Dental Anaesthesia, Royal College of Surgeons of England, 1981 (originally published in 1978). ‘The Wylie Report’.
[8] M.P. Coplans, R.A. Green, Mortality and morbidity studies, in: M.P. Coplans, R.A. Green (Eds.), Anaesthesia and Sedation in Dentistry, Elsevier, 1983, pp. 131–147.
[9] General Anaesthesia, Sedation, and Resuscitation in Dentistry. Report of an Expert Working Party for the Standing Dental Advisory Committee of the Department of Health, 1990. ‘The Poswillo Report’.
[10] ‘the “Conscious Decision” report’, A Conscious Decision. A Review of the Use of General Anaesthesia and Conscious Sedation in Primary Dental Care, The Department of Health. UK Macmillan Publishers, London, 2000.
[11] W.D.A. Smith, Under the Influence. A History of Nitrous Oxide and Oxygen Anaesthesia, 1982.
[12] S. Mokhtar, Child Mortality Rates Associated with General Anaesthesia for Dentistry in England and Wales, 2003 search with ‘… general anaesthesia and child mortality…’, http://www.ucl.ac/library/.
[13] D.R. Molen, P. Ashley, Hospital admissions for dental care in children: England 1997-2006, Br. Dent. J. 206 (7) (2009) E14, discussion 378-379.
[14] A. Padfield, Fifty years of chair dental anaesthesics and mortality, Hist. Anaesth. Proc. 29 (2000) 79–84.