

Amalgamation of management information system into anaesthesiology practice: A boon for the modern anaesthesiologists

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ABSTRACT

Over the years, traditional anaesthesia record keeping system has been the backbone of anaesthesiology ever since its introduction in the 1890s by Dr. Harvey Cushing and Dr. Ernest A. Codman. Besides providing the important information regarding patients' vital physiologic parameters, paper records had been a reliable source for various clinical research activities. The introduction of electronic monitoring gadgets and electronic record keeping systems has revolutionised the anaesthesiology practice to a large extent. Recently, the introduction of anaesthesia information management system (AIMS), which incorporates all the features of monitoring gadgets, such as electronic storage of large accurate data, quality assurance in anaesthesia, enhancing patient safety, ensuring legal protection, improved billing services and effecting an organisational change, is almost a revolution in modern-day anaesthesiology practice. The clinical research activities that are responsible for taking anaesthesiology discipline to higher peaks have also been boosted by the amalgamation of AIMS, enabling multicenter studies and sharing of clinical data. Barring few concerns in its installation, cost factors and functional aspects, the future of AIMS seems to be bright and will definitely prove to be a boon for modern-day anaesthesiology practice.

Key words: Anaesthesia information management system, anaesthesiology, clinical research, electronic data, paper records

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INTRODUCTION

The traditional anaesthesia records had been immensely helpful in eliciting patients' status and physiological responses during surgical procedure. These traditional record systems, which are still widely used in developing nations like India, convey important information related to cardio-respiratory parameters, temperature, fluid administration, pharmacological administration and neurological and renal parameters. This paper record keeping has traversed a long journey to its present state since it was first used by Dr. Harvey Williams Cushing and Dr. Ernest Amory Codman during 1890s. The evolution has been gradual, and only in the last two to three decades, the advent of newer technology

has progressively revolutionised the anaesthesia record keeping system.^[1] As compared to other medical and surgical specialties, the intensity and diversity of physiological and pharmacological data measured is the highest in anaesthesiology during the peri-operative period, which helps in the correct and timely treatment of any untoward complication.^[2,3]

Limitation of paper record systems

Though paper record keeping is still the mainstay in many countries, gradually it is following the path of oblivion with the penetration of electronic record keeping in peri-operative medicine. Besides the time spent in recording, it becomes all the more difficult if only a single anaesthesiologist is available, which is a more common occurrence in the Indian scenario. Such

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time-consuming exercises can interfere with delivery of quality care and timely services to the patient. Moreover, the data can be easily manipulated and sometimes may not depict the true sequence of events. Over a period of time, the papers can get damaged. Also, the abundance of data makes it difficult to store and analyse them systematically. Any irregularity or incomplete entry of data can cause economic losses to the concerned organisation. The danger of such data getting damaged by fire, water and so on always persists.^[2,3]

SWITCHING OVER TO ELECTRONIC RECORD KEEPING AND AIMS

The advent of electronic health record keeping has somehow revolutionised the data entry and storage.^[4] The trend of electronic health record keeping has grown with the introduction of anaesthesia information management system (AIMS). However, the adoption of AIMS has been on the slower side due to its high perceived costs, doubts over its utility and a perceived lower need as compared to the available monitoring systems.^[5] However, the global trend is changing with a larger number of anaesthesiology setups adopting AIMS.^[5] AIMS has gained widespread popularity in the western nations, which is evident from the fact that 44% of the US anaesthesia academic departments are either equipped with or striving for installation of AIMS.^[6] Somehow, this trend has not been able to cast a significant impact on developing nations like India where still majority of centres have been following traditional practice of record keeping.

Potential benefits of AIMS

AIMS not only helps to record physiological data on a large scale, but also, at the same time, interfaces with multiple disparate systems which allows correlation of anaesthesia relevant data with biochemistry lab, billing sections, radiological units, pharmacy and other systems [Figures 1-4]. The time-saving and resource utility of AIMS is reflected during clinical emergency when the electronic recording is done on an automatic basis, while it is extremely difficult for the anaesthesiologist to record all the statistics during this period [Table 1].

Patient care and AIMS

At large, the potential benefit of AIMS reaches the patient as it helps in improving the patient care. Once stored, the anaesthesia-related information about the clinical condition and physiological parameters can

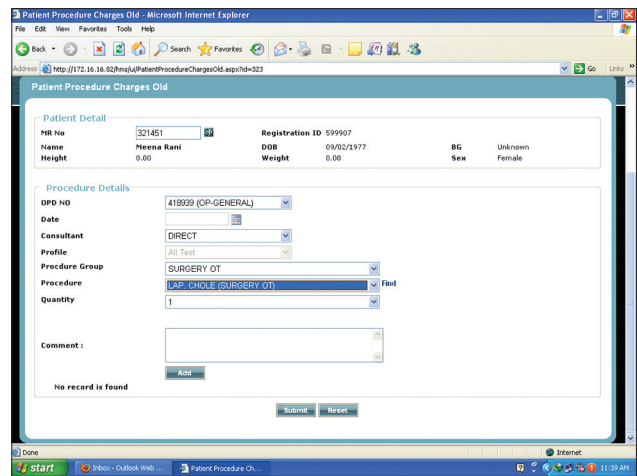


Figure 1: Utility of AIMS in the hospital setting for entering details of the patient posted for surgery

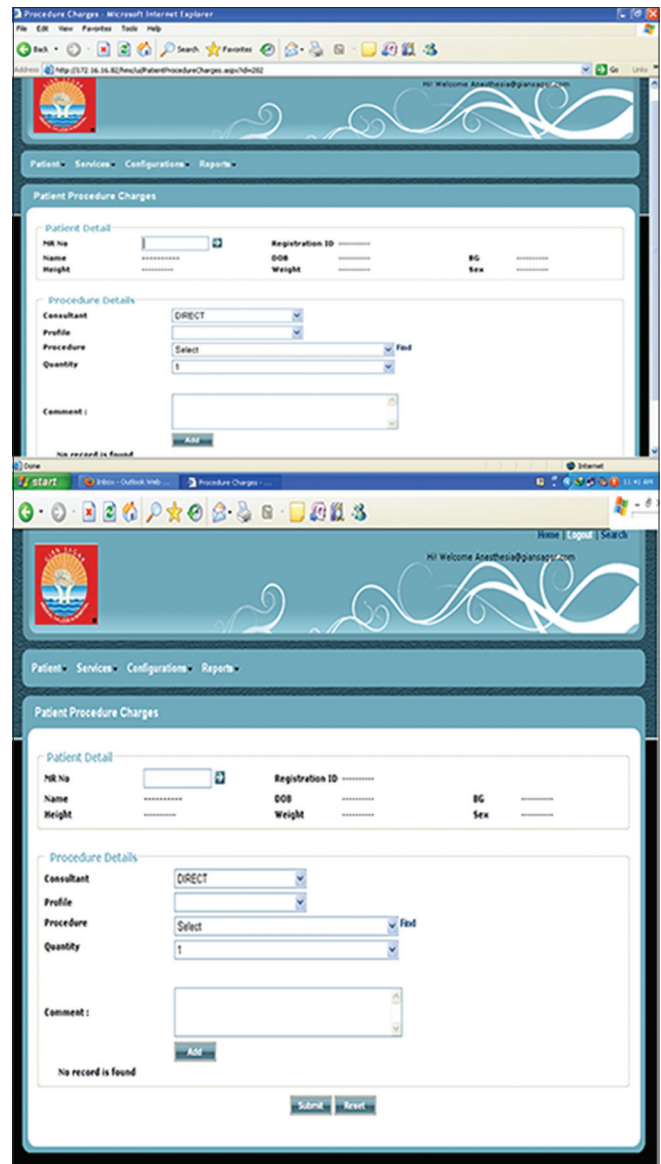


Figure 2: AIMS at work while entering patient data which is conveyed by intranet to different departments of the hospital

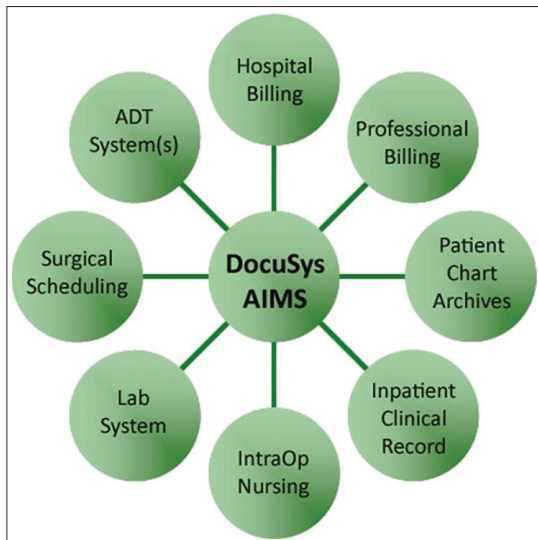


Figure 3: AIMS showing interfaces with other departments

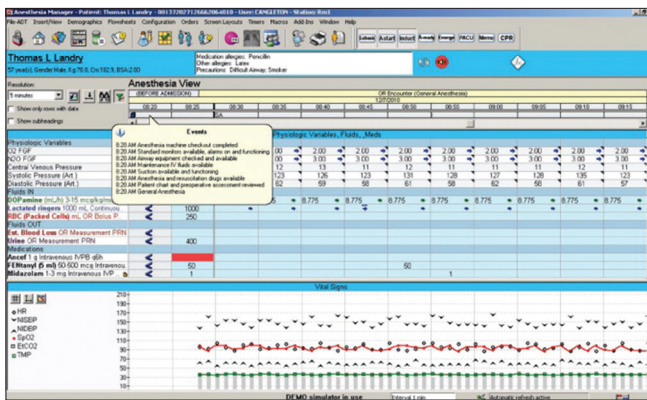


Figure 4: Patient record being shown with the help of AIMS

Table 1: Benefits of AIMS in anaesthesiology practice

Helpful in pre-anaesthetic evaluation by retrieval of previous records and entry of new data for future purposes
Ensuring patient safety and minimising medication errors
Assistance in drug dose calculation, reminders for drug administration and recording of any adverse drug event
Ensuring accuracy in recording patient's responses to anaesthesia
Reduction of anaesthesia drug costs
Provision of real-time clinical decision support in anaesthesiology practice
Quality assurance in anaesthesia
Development of risk management strategies
Detection of critical event during anaesthesia
Enhancement of clinical research activities and multicenter studies
Display of important algorithms and guidance, such as BLS, ACLS, trauma management, poisoning management, management of medical and surgical complications, etc.,
Improved billing metrics and enhanced revenue generation
BLS – Basic life support; ACLS – Advanced cardiac life support, AIMS – Anaesthesia Information Management System

be easily retrieved from the database, which can be helpful for revision surgery during the hospital stay or during later visits.

Quality assurance

Quality assurance has made significant inroads into anaesthesiology practice over the last few years. It can be achieved with the help of AIMS by retrieval of unbiased and error-free data from the large database especially related to critical or specific incidents.

Legal protection

Presently, anaesthesiologists also face potential continuous threats from Consumer Protection Act (CPA). AIMS can be legally helpful in the court of law as the data provided by AIMS is more accurate, contemporaneous and unbiased as compared to the manual records and can support the clinical decisions of the anaesthesiologists. AIMS has become an important part of risk management strategy.^[7]

Monitoring of anaesthesia department functioning

Anaesthesia faculty is widely dispersed throughout various clinical units and the department's functional activity is difficult to monitor as such. However, with the help of AIMS, it has become extremely easier to know the operation room turnover time, duration of surgery, time periods of various anaesthetic events and the total hours of surgery in a day. This can also be helpful in the budgetary allocation of drugs, equipment and other relevant inventories, as well as to establish the departmental protocols and guidelines with the help of accurate data and feedback suggestions from its analyses.^[8]

Anaesthesiologist's involvement in running AIMS

Anaesthesia personnel are best suited for managing the resources and inventories of operation theatre. The requirements and the necessities of operation theatre can be easily analysed and recorded and this can be further facilitated by connecting the AIMS with the purchase section, which ensures that the equipment bought is of highest quality and is cost effective.^[4]

Organisational change by AIMS

An important social feature of AIMS is its potential ability to bring a change in the behavioural aspects of the clinicians and can make them dedicated practitioners of anaesthesiology by overcoming the technical and functional barriers in an organisation. It has been observed that once the anaesthesiologists become friendly with AIMS, they do not want to revert to manual systems.^[9,10] The comparison of AIMS with handwritten record has established the superiority of AIMS over the manual entries as the former saved lot of time, recorded larger data and yielded only fewer illegible entries.^[11]

Performance improvement and patient safety

AIMS had been used to develop algorithms to identify high-risk patients who required higher doses of antiemetics.^[12] AIMS can have a role in enhancing safety measures in surgical patients by screening of intraoperative markers of complications. The electronic screening can identify higher numbers of cases of academic interest than that voluntarily reported by physicians.^[13] AIMS can facilitate use of bar codes and utilisation of special screening devices to accurately identify and improve documentation, which can significantly diminish the incidence of medication errors.^[14] The retrieval of important information of a particular patient can be really helpful during emergency situations such as difficult airway, cardiac arrest and trauma.

Economical utility

Besides providing the clinical data for billing purposes, AIMS can also be helpful in point-of-care change capture system. Thus, it can eliminate a lot of paper work and the time required for billing purpose, as well as reduces the requirement of manpower, which can prove to be extremely economical, and improves the overall billing metrics.^[15]

Alignment with various national programmes and schemes

It can be used to align patient care services especially for those patients who are enrolled on various national and regional schemes such as those run by National Rural Health Mission (NRHM) and various social organisations and insurance companies, thus providing timely and quality care at affordable prices.^[16]

Tracking patient's movements during hospital stay

Patient movement and location during peri-operative period through different areas can be easily tracked with the help of AIMS. The entire sequence of events, including the peri-operative events such as induction of anaesthesia, intubation, peri-operative vitals, recovery, and so on, is automatically documented. The tracking options make the system more transparent, thereby allaying the anxiety and unknown fears of family members and friends by showing real-time movement of the patient on a screen.^[17]

Clinical research activities

Clinical research and documentation

The aggregate data can be extrapolated to assess patient care even in a broader manner. AIMS can be immensely helpful in clinical research studies, both prospective and retrospective, which can save up to 10-15% of anaesthesiologist's precious time that is usually spent

in manual documentation.^[18] A slight apprehension with regards to usage of AIMS is the possibility of decreased vigilance during anaesthesia, but there is no literary evidence available to establish this claim.^[19]

Simplification of data collection methods and multicenter research

AIMS can also provide a platform for generating hypothesis, recording information about rare diseases, enabling multicenter studies and helps in screening of patients during pre-anaesthetic check-up for possible inclusion in the research study based on inclusion criteria^[20] [Table 2]. The data entry should be precise in the free text field, which is made possible by taking help from various default coding systems.^[21]

Ensuring accuracy in data collection

Artefacts in measuring the physiological parameters such as heart rate, blood pressure and central venous pressure can lead to collection of inaccurate results. Artefacts because of power failure, positioning of the patient or nature of surgery can compromise the data recording. Interventions and titration of various therapeutic measures on minute-by-minute basis is always the aim, but is not possible every time in actual anaesthesia practice with a single operator. The actual events like induction and administration of a particular drug may not be marked or noted at the right moment, but can be incorporated in the data at leisure. Further, there is no uniform consensus among anaesthesiologists across the globe about the definitions and limits of various abnormal physiological values. Parameters such as blood pressure vary among different age groups, especially in the presence of co-existing medical disorders, which is another limitation of AIMS.^[22]

Maintaining smoother functioning of AIMS

A separate department or a group of dedicated individuals can maintain the software, hardware and

Table 2: Potential beneficial effects of AIMS in anaesthesiology clinical research activities

Potential benefits

Storage of large amount of data
Ensuring the accuracy of data
Saving of precious time in retrieval of data
Ensuring patient safety-focus on patient and not on documenting data
Emergency and critical event detection
Improved quality assurance
Enabling multicenter trial and studies
Possible help in statistical analysis of patient data
AIMS – Anaesthesia Information Management System

other functional features of AIMS. An anaesthesiologist who is well versed with the clinical and administrative workflow of the department can take a lead here and his knowledge and skills of management will definitely prove helpful in running AIMS. Alternatively, such types of training schedules can be incorporated into the post-graduate curriculum as well.

Identification of personnel for success of AIMS

This is all the more important as anaesthesiology billing section is the largest user of such systems. Identification of a clinical champion to manage such projects can really help in better workflow. Moreover, in larger institutes, the presence of a bio-medical engineer is absolutely necessary to run and maintain various electronic equipments and help in troubleshooting any snag in physical connections and the interfaces between anaesthesia equipment, monitoring devices and AIMS.^[23]

Administrative and functional aspects related to AIMS

Though it seems that installation of such projects may be costly, studies have established that in long term, such technology can ensure patient safety, precise and improved clinical data, quality assurance and improvement in anaesthesia.^[24]

Various manufacturers of AIMS have been incorporating new functional options depending upon the feedback from the medical faculty and administration. The utility can be enhanced only if anaesthesia department and the administrative staff work in tandem to bring out the weak points so as to improve the overall utility of AIMS for the betterment of mankind and economy.^[25]

Selection of an appropriate AIMS

The biggest advantage of AIMS in upcoming corporate hospitals seems to be the saving of costly time as it hardly takes a few seconds to retrieve the information required for administration of drugs, preparation for surgery, timely retrieval of patient's vital parameters, various billing purposes and for taking various decisions by the administrative staff. The functionalities of AIMS have to be specified by each and every department for their own benefit before such systems can be installed in the hospital arena.

CONCLUSION

At present, the popularity of AIMS has just started to build up as is evident from its global penetration of 15% in all the academic institutions and corporate hospitals. However, there is no denying the fact that

potential benefits of AIMS far outweigh its cost factors. The accuracy of data monitoring and recording, time saving, billing metrics, legal protection and a major role in clinical research activities have ensured a permanent place for AIMS in modern-day anaesthesiology practice and it has come as a boon for the anaesthesiologist.

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Announcement

Conference Calendar Details

Name of the conference: 62nd Annual National Conference of the Indian Society of Anaesthesiologists, ISACON 2014
Date: 25th to 29th December 2014
Venue: Velammal Medical College "Velammal Village", Madurai – Tuticorin, Ring Road, Annupanadi, Madurai – 625009, Tamil Nadu, India
Organising Secretary: Prof. Dr. S C Ganesh Prabhu, ISACON 2014, Institute of Anaesthesiology, Government Rajaji Hospital, Panagal Road, Madurai – 625 020, Tamil Nadu, India
Contact: +91 93448 17143, 94434 96835
 E-mail: isaconmadurai2014@gmail.com
 Website: www.isacon2014.com

Name of the conference: ISA VISZAC 2014 - SOUTH ZONE
Date: 22nd to 24th August 2014
Venue: Amcosa Hall, Visakhapatnam
Organising Secretary: Dr. A Satyanarayana
Contact: +91 98491 26512
 E-mail: isaconmadurai2014@gmail.com
 Website: www.viszac2014.com

Name of the conference: 17th RAJASTHAN STATE CONFERENCE 2014
Date: 04th to 5th October 2014
Venue: Tantia General Hospital, Sukhadiya Marg, Sri Ganganagar, Rajasthan
Organising Secretary: Dr. Seema Maheshwari
Contact: +91 94621 78561
 E-mail: info@rajisacon2014.in
 Website: www.rajisacon2014.com

Name of the conference: KISACON 2014, 30th Annual Karnataka State Conference
Date: 10th to 12th October 2014
Venue: Department of Anaesthesiology, SDM College of Medical Sciences and Hospital, Manjushree Nagar, Sattur, Dharwad - 580009, Karnataka
Organising Secretary: Dr. Shyam Sunder Kamath
Contact: +91 99004 13473
 E-mail: kisacon2014@gmail.com
 Website: http://kisacon2014.com

Name of the conference: NEZACON 2014 - NORTH EAST ZONE
Date: 11th to 12th October 2014
Venue: Department of Anaesthesiology, AGMC & GBP Hospital, Agartala, Tripura
Organising Secretary: Dr. Biswajit Chakraborti
Contact: +91 94364 68156
 E-mail: chakrabortibiswajit2@gmail.com

Name of the conference: 7th NATIONAL CONFERENCE, ASSOCIATION OF OBSTETRIC ANAESTHESIOLOGISTS (AOA)
Date: 17th to 19th October 2014
Venue: K N UDUPA Auditorium, Banaras Hindu University, Varanasi
Organising Secretary: Dr. P Ranjan
Contact: +91 94159 86684
 E-mail: aoacon2014@gmail.com
 Website: www.aoacon2014.com

Name of the conference: 17th MISACON and 11th WISACON 2014
Date: 31st October to 2nd November 2014
Venue: Hotel Grand International, Barshi Road, Latur, Maharashtra
Organising Secretary: Dr. Santosh Gitte
Contact: +91 98223 35235
 E-mail: misaco2014@rediffmail.com
 Website: www.misaco2014.com

Name of the conference: 15th Annual Conference of Indian Society of Anaesthesiologists-North Zone (NZISACON 2014)
Date: 31st October to 2nd November 2014
Venue: Acharya Srichander College of Medical Sciences and Hospital, Jammu
Organising Secretary: Dr. Nandita Mehta
Contact: +91 94191 95424
 E-mail: drnanditamehta@gmail.com
 Website: http://nzisacon2014.org

Name of the conference: RSAPCON 2014 - 24th Annual Conference of Research Society of Anaesthesiology Clinical Pharmacology
Date: 14th to 16th November 2014
Venue: Department of Anaesthesiology & Pain Management HIMs, HIHT University, Swami Ram Nagar, Jolly Grant, Dehradun, Uttarakhand - 248140
Organising Secretary: Dr. J P Sharma
Contact: +91 94117 18466
 E-mail: info@rsapcon2014.com

Name of the conference: ICA CON - 2014
Date: 21st to 23rd November 2014
Venue: Narayana Hrudayala Hospitals #258/A, Bommasandra Industrial Area Anekal Tk, Bangalore, Karnataka
Organising Secretary: Dr. Muralidhar Kanchi
Contact: +91 99801 63108
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