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Original Article / Özgün Araştırma

Peri-Operative Anaesthetic Documentation: A Report of Three Sequential Audits on the Quality of Outcomes, with an Insight Into Surrounding Legal Issues

Peri-Operatif Anestezi Dokümentasyonu: Yasal Sorunlar Açısından Üç Ardışık Kalite Denetiminin Raporu

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Abstract /Öz

Objective: The aim of the audits was to assess contemporary performance, with comparison of the same against previous outcomes, to gauge trends in clinical practice. This allowed for completion of the audit cycle, as well as the ability to analyse and consistently improve the quality of care delivered to our patients.

Methods: We undertook three prospective audits on the quality of peri-operative anaesthetic documentation in the years 2009, 2011 and 2014, respectively. Anaesthetic records for patients undergoing elective as well as emergency surgical procedures were assessed for 'adequacy of peri-operative documentation' based on a combination of select criteria outlined by the Royal College of Anaesthetists and the Australian and New Zealand College of Anaesthetists.

Results: A total of 1000 anaesthetic records were analysed in 2009, followed by a review of 412 records and 376 documents in 2011 and 2014 respectively. In the year 2014, 43.8% of pre-operative anaesthetic records were 'appropriately' documented. This was in stark comparison to 16.3% and 25.9% in the years 2009 and 2011, respectively. The quantity of 'adequately' documented intra-operative records increased to 35.1% in 2014, in comparison to 25.5% and 22.7% in 2009 and 2011, respectively. There was an overall improvement in the standards of peri-operative documentation in consecutive audits.

Conclusion: We propose that regular audits on 'anaesthetic record keeping' can lead to an improvement in the standards of this often overlooked, but essential scope of our practice.

Keywords: Medical records, electronic record, documentation, quality improvement

Amaç: Denetlemelerin amacı güncel performansı önceki sonuçlarla kıyaslayarak değerlendirmek ve klinik uygulamadaki trendleri göstermekti. Bu, denetleme döngüsünün tamamlanmasına ve de hastalarımıza sunulan bakımın kalitesini analiz etmeye ve sürekli olarak geliştirmeye olanak sağladı.

Yöntemler: Sırasıyla 2009, 2011 ve 2014 yıllarında peri-operatif anestezi dokümentasyonunun kalitesine yönelik üç prospektif denetleme yapıldı. Acil cerrahi işlemlerin yanı sıra elektif cerrahi geçiren hastaların anestezi kayıtları, Kraliyet Anestezistler Koleji ve Avustralya ve Yeni Zelanda Anestezistler Koleji tarafından oluşturulan kriterlerin kombinasyonuna dayanarak, 'peri-operatif dokümentasyon yeterliliği' açısından değerlendirildi.

Bulgular: 2009 yılında toplam 1000, 2011 yılında 412 ve 2014 yılında 376 anestezi raporu incelendi. 2014 yılında, pre-operatif anestezi kayıtlarının %43,8'inin 'uygun' olarak belgelendiği görüldü. Bu oran 2009 yılında %16,3 ve 2011 yılında %25,9 idi. 2009 ve 2011 yıllarındaki sırasıyla %25,5 ve %22,7 oranlarıyla kıyaslandığında, uygun bir şekilde belgelenen intraoperatif kayıtların oranı 2014 yılında %35,1'e yükseldi. Birbiri ardına yapılan denetlemelerde perioperatif dokümentasyon standartlarında genel bir iyileşme vardı.

Sonuç: Anestezi kayıtlarının tutulmasına yönelik düzenli denetlemelerin, sıklıkla dikkate alınmayan ancak uygulamamızın gerekli bir alanı olan standartlarda iyileşmeye katkı sağlayabileceğini ileri sürmekteyiz.

Anahtar Kelimeler: Tıbbi kayıtlar, elektronik kayıt, dokümentasyon, kalite geliştirme

Introduction

The 'anaesthetic record' forms an integral part of a patient's journey through the hospital system. In a true sense, it is a clinical, scientific, legal and administrative document relating to patient care, depicting relevant information in a sequential fashion, thereby justifying the diagnosis, the implemented treatment and obtained end-result. In short, an anaesthetic record captures a patient's 'comprehensive' anaesthetic experience in a succinct format (1).

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Given its utmost importance, and in spite of the time and effort spent by anaesthetists on peri-operative documentation, measured outcomes continue to be comparatively mediocre (2-4). Numerous professional bodies including the Australian and New Zealand College of Anaesthetists (ANZCA), American Society of Anesthesiologists (ASA) and Canadian Anesthesiologists' Society (CAS) have outlined the necessity for adequate, accurate and legible anaesthetic records (4).

Apart from medico-legal implications, lack of proper documentation can be detrimental to the quality of care provided to patients, thereby compromising the basic underlying principles of 'clinical governance'.

Methods

Being a quality assurance project, formal approval from the Ethics Committee was not required (Human Research and Ethics Committee, The Queen Elizabeth, Lyell McEwin & Modbury Hospitals, Chair: Dr Timothy Matthew, 15th September 2014).

Three consecutive prospective audits on the quality of peri-operative anaesthetic documentation were undertaken as part of departmental quality assurance program at a tertiary care centre in South Australia in the years 2009, 2011 and 2014 respectively. All anaesthetic records for patients undergoing elective as well as emergency surgical procedures were assessed for 'adequacy of peri-operative documentation'. Anaesthetic records of patients admitted to intensive care and those undergoing procedures at remote locations were excluded from the audit. To avoid performance bias, data collection was performed without prior intimation to the members of the anaesthetic department. Pre- and intra-operative information was manually entered on pre-designed anaesthetic charts, with dedicated space for requisite information. This format for documentation had been in use at the hospital for more than 10 years, prior to the introduction of the Electronic Patient Administration System (EPAS®) in the latter half of 2016.

The 'core criteria' for appropriate documentation were determined based on a combination of select criteria outlined by the Royal College of Anaesthetists (5) and ANZCA (6) in 2009. If the anaesthetic records met the criteria listed for 'adequacy of documentation', they were labelled as 'appropriately documented.'

Anaesthetic records were photocopied by nursing staff in the post-operative care unit (PACU). All patients and clinicians performing the pre-anaesthetic assessments, as well as the clinical conduct of anaesthesia, were de-identified during the process of assessment. A Microsoft Excel database was used for data entry and collation in 2009. Subsequent data entries were performed on a dedicated Microsoft Access database in the years 2011 and 2014.

Patient Details	Smoking
Date of Assessment	Alcohol
Date of Surgery	Cardiovascular History
Surgical procedure	Respiratory History
Emergency or elective procedure	Other Past Medical History
Age (years)	Airway Assessment
Weight (kg)	Medications
Blood Pressure	ASA Status
Heart Rate	Relevant Investigations
Allergies	Reviewing Anaesthetist
Past Anaesthetic History	Anaesthetic Plan
History of Reflux or Full Stomach	Explanation to patient

Patient Details	Alcohol
Planned procedure	Cardiovascular History
Weight (kg)	Respiratory History
Blood Pressure	Other Past Medical History
Heart Rate	Medications
Allergies	Airway Assessment
Past Anaesthetic History	ASA Status
Smoking	Reviewing Anaesthetist

Figure 1. a, b. (a) Pre-operative information collected. (b) Pre-operative information assessed for 'adequacy of documentation'

Patient Details	End-tidal carbon dioxide
Date of Procedure	Medications
Identity of Anaesthetist	Ventilation details
Identity of Surgeon	Position of patient
Surgical Procedure	Regional block details (if applicable)
Intravenous access details	Eye protection (if applicable)
Type of airway device (if applicable)	Temperature monitoring
Size of airway device (if applicable)	Care of pressure points
Grade of laryngoscopy (if applicable)	Warming measures
Monitoring modalities	Intravenous fluids
End-tidal agent concentration	Heat moisture exchanger
Oxygen saturation	Post-operative orders
Blood pressure and heart rate	

Date of Procedure	Blood pressure and heart rate
Identity of Anaesthetist	End-tidal carbon dioxide
Identity of Surgeon	Medications
Surgical Procedure	Position of patient
Intravenous access details	Eye protection (if applicable)
Type of airway device (if applicable)	Care of pressure points
Grade of laryngoscopy (if applicable)	Intravenous fluids
End-tidal agent concentration	Post-operative orders
Oxygen saturation	

Figure 2. a, b. (a) Intra-operative information collected. (b) Intra-operative information assessed for 'adequacy of documentation'

The 'overall collected' and 'requisite' information required for an anaesthetic record to be labelled as 'appropriately documented' is shown in Figures 1a and b, Figure 2a and b, respectively. All collected information was compared against 'pre-determined criteria', formulated by the process as discussed above.

Collection of information pertaining to temperature, urine output and blood loss was discontinued in 2014 as it was not applicable to all patients. Importantly, presence of patient identity labels was not included in the 'core criteria' for 'adequacy' of intra-operative documentation. This is because the anaesthetic chart was a two-page document, the first page being devoted to pre-anaesthetic assessment (which had a patient identification label) and the second page being dedicated to recording of intra-operative parameters.

The data for 'priority of surgery' (emergency or elective) were not collected in the first audit in 2009, and compliance was quite poor in the second audit in 2011. Looking at this, data collection for the same was discontinued in the last audit in 2014, and henceforth, this information was not included in the compilation of results.

Statistical analysis

Correlation between differences in results was assessed using Pearson's chi-squared test. Statistical significance was achieved at a P-value of less than 0.05. All statistical analyses were performed using Stata 15.1 (Stata Corp College Station, TX, USA).

Results

Data from a total of 1000 anaesthetic records were collected in 2009. Out of these, 998 records were included for pre-operative information (two duplicates) as opposed to 993 for intra-operative documentation (seven duplicates or incompletely photocopied records). Subsequently, 412 consecutive anaesthetic records were assessed in 2011. A total of three records were excluded on account of being duplicates, thereby leaving a balance of 409 for final analysis. Finally, 376 records were included in the third audit in 2014. Enhanced clinical commitments of PACU staff necessitated the quantitative reduction in the numbers in consecutive audits.

The outcomes of documentation of pre-operative information are shown in Table 1. There was a trend towards significant improvement in the recording of the majority of pre-operative parameters (cardiovascular and respiratory history, medications, allergies, as well as lifestyle issues). Of note, airway assessment, which is considered as one of the core components of an anaesthetic assessment, was documented in only 91.2% of the patients in 2014, although up from 80.7% in 2011. Relevant investigations were registered in only 35.1% of the pre-anaesthetic assessments in 2014, which apparently still leaves a vast room for improvement. These findings are summarised in Figure 3.

There was an overall improvement in the standards of documentation of pre-operative assessments over the course of the three audits (Table 2 and Figure 4). A total of 43.8% of pre-operative records were 'appropriately documented' in 2014, as

Table 1. Pre-operative information documented (%) in 2009, 2011 and 2014

Pre-op Parameters	2009	2011	2014
Patient details	99.7	100	100
Date of assessment	91.6	94.4	95.5
Date of surgery	61.8	87.0	76.5
Surgical procedure	94.4	97.1	97.6
Age (years)	83.2	83.1	80.3
Weight (kg)	69.8	85.3	87.2
Blood pressure	53.3	78.0	79.5
Heart rate	38.7	74.1	79.5
Allergies	98.3	98.3	98.9
Past anaesthetic history	98.0	94.9	97.8
History of reflux or full stomach	74.2	79.7	82.2
Smoking	80.2	85.1	90.7
Alcohol	64.3	63.1	73.9
Cardiovascular history	91.4	92.9	99.5
Respiratory history	86.4	90.2	98.7
Other past medical history	83.2	88.8	98.7
Airway assessment	95.8	80.7	91.2
Medications	97.2	98.0	98.7
ASA status	97.5	98.0	99.2
Relevant investigations	39.4	57.0	35.1
Reviewing anaesthetist	97.1	77.0	84.8
Anaesthetic plan	95.8	98.0	85.4
Explanation to patient	85.5	81.4	86.9

Table 2. Appropriately documented pre-operative anaesthetic records in 2009, 2011 and 2014

Year	Total (n)	Appropriate	% Appropriate
2009	998	162	16.3%
2011	409	106	25.9%
2014	376	165	43.8%

2009 vs. 2011 p=0.0001. 2009 vs. 2014 p=0.0001. 2011 vs. 2014 p=0.0001

Table 3. Intra-operative information documented (%) in 2009, 2011 and 2014

Intra-operative Parameters	2009	2011	2014
Patient details	99.3	97.3	92.3
Date of procedure	98.6	98.0	96.5
Identity of anaesthetist	99.1	96.1	90.7
Identity of surgeon	74.6	72.6	69.1
Type of airway device	93.2	95.8	97.2
Grade of laryngoscopy	95.8	94.1	93.2
End-tidal anaesthetic agent	95.8	93.7	93.3
Oxygen saturation	97.7	95.4	94.7
Blood pressure & heart rate	99.5	94.1	98.9
End-tidal carbon dioxide	94.9	92.7	92.9
Position of patient	90.8	83.6	83.8
Eye protection	71.5	69.1	81.0
Care of pressure points	59.8	56.7	61.0
Warming measures	47.0	43.8	56.1
Intravenous fluids	97.0	97.8	96.0
Heat moisture exchanger	3.3	4.3	11.2
Post-operative orders	99.6	98.0	97.0

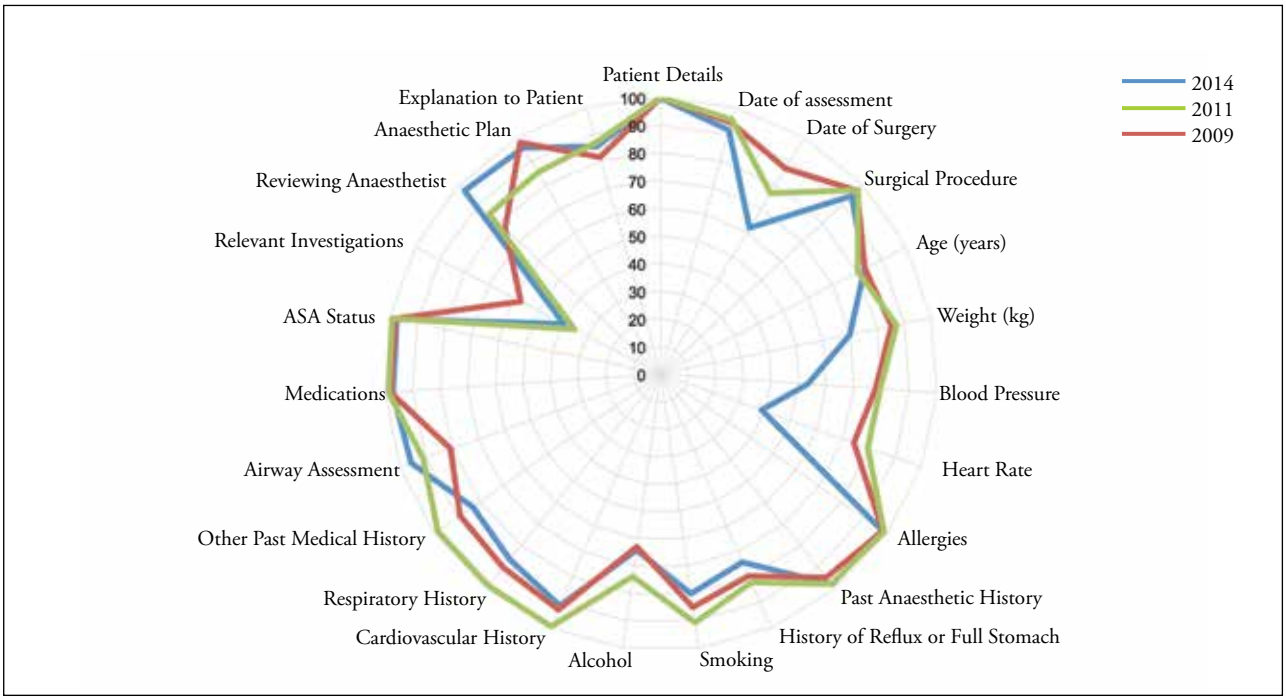

Figure 3. Proportion of pre-operative information adequately documented

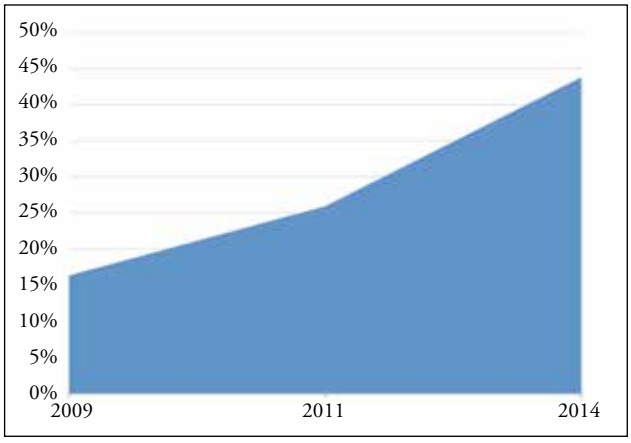

Figure 4. Trend of adequately documented pre-operative anaesthetic records

opposed to 25.9% in 2011 ($p<0.001$) and merely 16.3% in 2009 ($p<0.001$). This reflects more than twofold improvement over the course of 5 years, which in itself is very reassuring.

Table 3 shows the results for documentation of 'intra-operative parameters'. Of note, there was an improvement in the incidence of documentation of eye care, protection of pressure areas, airway devices and end-tidal carbon dioxide concentration.

Heat moisture exchanger (HME) and active patient warming were the least frequently recorded parameters, although with an improved outcome in comparison to previous audits.

There was a decline in the incidence of documentation of the proceduralists (anaesthetists as well as surgeons) and surgical procedures undertaken. These findings are summarised in Figure 5.

The final analysis of results for documentation of intra-operative information showed an overall improvement in the quantity of 'appropriately' documented records (Table 4 and Figure 6). In total, 35.1% of the intra-operative records were 'optimally' documented in 2014, up by nearly 10% from the first audit in 2009 ($p<0.05$). Comparison of results from 2014 with those from 2011 demonstrated a high statistical significance ($p<0.001$).

Discussion

The requirement for written documentation dates back to the Napoleonic civil code adopted under Louis XIV of France in 1667 (7). The first anaesthetic record, the famous 'Ether chart' was devised by Cushing and Codman in 1894 (8). Based on his own collection, the importance of anaesthetic records was further emphasised by Lundy in 1924 (9).

The goal of an anaesthetic record is to capture a patient's response to anaesthesia and surgery by recording the physiological changes, procedures, key events and pharmacological interventions performed throughout the peri-operative period (1). There is no other clinical setting in which such an abundance of physiological and pharmacological data collection is performed.

An 'anaesthetic record' should be accurate, legible, elaborate and have a signature verifying the 'authenticity and truthfulness' of the document. It functions as a data log and ther-

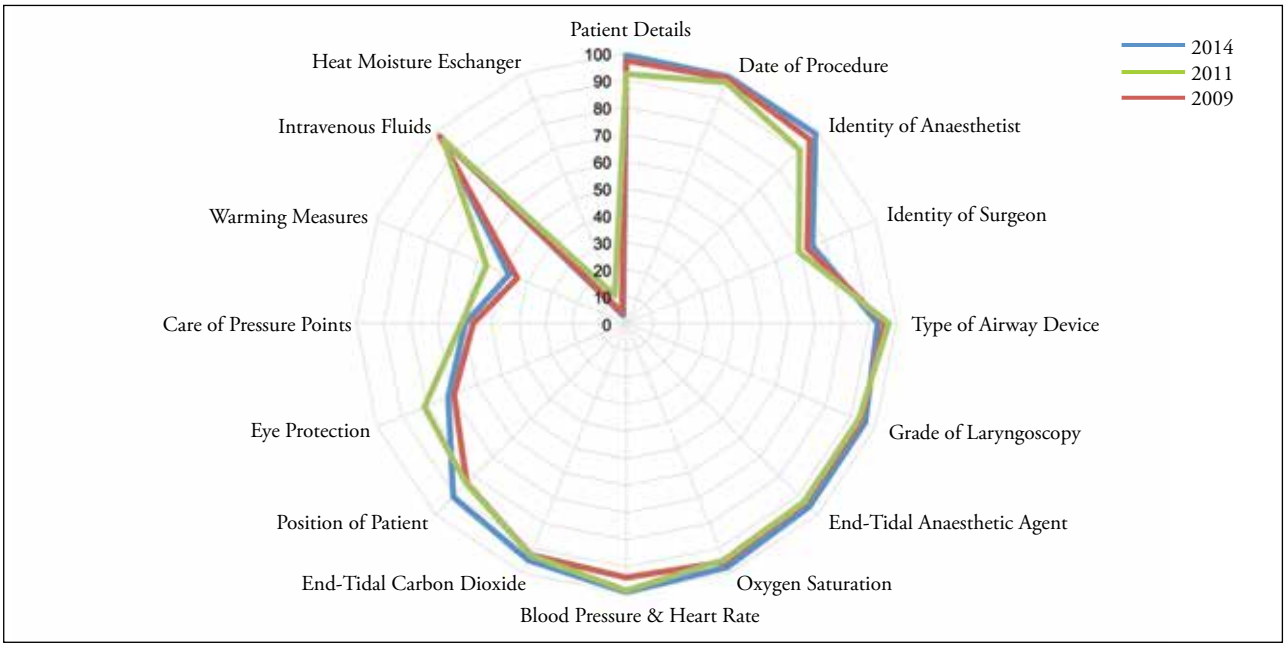

Figure 5. Proportion of intra-operative information adequately documented

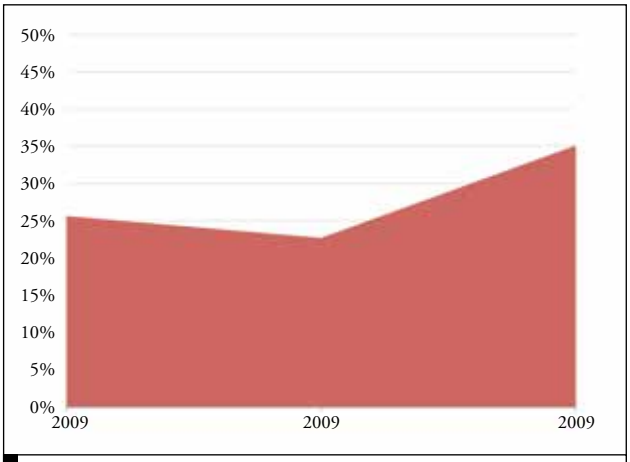

Figure 6. Trend of appropriately documented intra-operative anaesthetic records

Table 4. Appropriately documented intra-operative anaesthetic records in 2009, 2011 and 2014

Year	Total (n)	Appropriate	% Appropriate
2009	993	255	25.5%
2011	409	93	22.7%
2014	279	98	35.1%

2009 vs. 2011 p=0.246. 2009 vs. 2014 p=0.0001. 2011 vs. 2014 p=0.0001

apeutic planning tool, as well as a document for reference during subsequent anaesthetic exposures (7). By means of providing trend analysis and defining events on a time scale, an anaesthetic record allows for appropriate therapeutic planning during future anaesthetic encounters, thereby optimising clinical outcomes. Subsequently, it ends up as a medico-legal document and potentially as a business record.

In our instance, 43.8% of the pre-operative records were 'appropriately' documented in 2014 (Table 2 and Figure 4), up from 16.3% in 2009. A similar positive trend was observed in the documentation of intra-operative records, with the number of 'optimally charted' records standing at 35.1% in 2014, as opposed to 22.7% in 2011 (Table 4 and Figure 6). There was a consistent improvement in the standards of practice with each audit, both in pre- as well as the intra-operative categories. Improvements of 17.9% and 12.4%, respectively, were recorded in 2014, when compared against similar outcomes in 2011.

The attainment of these encouraging results was attributed to the dedication, periodic follow-up and initiative undertaken by the departmental anaesthetic staff. In addition, persistent reminders and emphasis on the importance of good record keeping played a significant role in the consistent improvement of standards. We find these results very encouraging and strongly feel that the quality of peri-operative documentation is a reflector of the quality of care provided to patients.

The low rates of documentation of HME and warming may be related to its inapplicability in select clinical circumstances (e.g. patients undergoing procedural sedation and regional blocks). Importantly, as it is part of the 'standard of care' for general anaesthesia at our institution, it may not have been deemed necessary to document individually by the majority of the anaesthetists.

Additionally, the low rates of documentation of identity of surgeons was found to be concerning. This issue has been addressed by installation of tailor-made white boards in every operating room. These boards identify the whole theatre team, as well as carry relevant information pertaining to the

patient (name, date of birth, registration number and allergy status). In addition to facilitation of patient checks prior to surgery, this has further helped to enhance communication and teamwork within the theatre team.

The prospective nature and the quantity of records analysed during this exhaustive exercise is a major strength of this project as it allowed us to get a true picture of our contemporary performance and more importantly, gauge the dynamicity of the trends in practice.

A similar audit by Raff and James (2) found that out of 284 records, only 29.9% met the 'minimum standards' required for data entry. Interestingly, intra-operative vital signs were not intelligible in 53% and surprisingly absent in 19.5% of the documents. Furthermore, anaesthetic drugs were not recorded in 12.5% and illegible in 26.5% of the instances. A French study by Falcon et al. (3) highlighted similar deficiencies, both in pre- as well as intra-operative records.

To the best of our knowledge, there is only one published audit assessing the adequacy of peri-operative documentation against the ANZCA guidelines in contemporary literature. In this audit, only 32% of the pre-anaesthetic records and 27% of the intra-operative encounters were considered to be compliant with existing recommendations (4).

Our sub-optimal performance could partly be attributed to the unfamiliarity of some staff members with the records' format used at our institution. Our hospital is a tertiary teaching facility and gets new rotational trainees twice a year as part of the training scheme. In addition to provision of clinical services, time pressures during busy operating lists may have placed significant demands on the attending anaesthetist, thereby compromising the quality of documented records. Lastly, the impact emergency surgery and inter-individual variability on peri-operative documentation of anaesthetic records cannot be overlooked.

There is a paucity of quality studies on peri-operative documentation in contemporary literature. This may in part be related to the exhaustive nature of the process, which involves voluminous data collection and collation of all clinical parameters to come up with any fruitful conclusions.

Anaesthetic records may be either manual or automated. Paper records are time consuming and prone to subjectivity, incompleteness and data entry bias (8). They can be illegible at times, thereby making it difficult to subsequently audit the data. Electronic record-keeping systems are currently gaining popularity as a tool to enhance objectivity, accuracy and cost-effectiveness. These systems have been shown to produce more accurate physiological data (4) and could represent better utilisation of manpower and resources. This would theoretically lead to an improvement in the standards of documentation as well as clinical care, as anaesthetists could focus on higher level tasks in lieu of charting data. These systems have been endorsed to enhance detection of adverse events under anaesthesia and as a tool for quality improvement (10). Interestingly, Elhalawani et al. (4) did not find any difference in the adequacy of documentation between manually and electronically generated records in their study.

Automated systems take away the role of the 'human scribe', who is intelligent, responsive and most importantly, a 'valuable team member'. Additionally, they provide poor feedback and can interrupt efficient teamwork during times of high workload or clinically stressful periods (11). Also, they bring along with them their own set of controversies. This is highlighted in a recent case report, where failure to recognise loss of incoming data by an automated record-keeping system may have increased medical liability (12). Theoretically, the operator is dependent on the ability of the operating system to perform the task which it has been marketed to do. This is the principle of 'justifiable reliance'. The failure of a serviced product during routine use can create a potential for a product liability suit by means of 'breach of warranty'. This may theoretically create a basis for 'sharing of liability'. However, many vendors of automated record systems disclaim liability for their products, but the extent to which this protects them from liability is not clear (7).

'Justifiable reliance' is counterbalanced by the principle of 'non-delegable duty', which implies that it is the duty of the health care professional to verify his or her own records. This can be a contentious issue, as the argument in favour of 'justifiable reliance' becomes significantly stronger in the presence of rapid and overwhelming data in the context of complex clinical situations. In contrast, with manual records, the argument in support of 'non-delegable duty' grows stronger, as the volume of information is limited, and there are no minimum cut-off standards. There should be clear policies in departments using electronic records, as this could help define acceptable standards and thereby limit institutional liability (7).

A signature, either 'manual' or 'electronic' attests the 'authenticity' and 'veracity' of the document, thereby signifying acceptance of information in the same. The important message is that medical records should be accurate and complete and that the use of an automated record does not absolve the signing physician of liability in case of 'incompleteness' or 'missing information' (7). The paramount importance of mindfulness and vigilance in this regard cannot be overemphasised.

Lastly, it is important to clarify which document is the 'official' or 'original' medical record. This is fairly simple with manual documentation, where only one copy exists. With automated systems, the data are first collected and stored is the 'original record'. Copies never have the same value as the 'actual record' and may be contested in a court of law. Printouts are 'secondary documents' and may not reflect electronic data accurately as they depict information accessed only at a specific point of time. However, the printed record is a 'le-

gally acceptable' summary, provided that electronic data are available for examination and authentication, if requested (7).

The future could have a lot more novelties in store for clinicians. Touch screen monitors, which were part of fiction a decade ago, have become a reality now. Very soon, we could be looking at smartphone applications for data log and transmission. Further on, bar-coded endotracheal tubes, syringes, ampoules and intravenous fluids could take a lot of workload off anaesthetists. And let us not to forget to mention speech-enabled computers and, possibly, theatre robots!

The incorporation of electronic data systems into contemporary practice is likely to bring its own set of challenges and controversies to the practice of clinical medicine. Clinicians generally lack familiarity with fundamental legal principles, and it is important for them to develop a better understanding of the way electronic data are captured, stored and processed.

Our audits are not devoid of drawbacks. Firstly, we could not sustain the numbers in consecutive audits on account of logistical issues, which necessitated the scaling down of the magnitude of the exercise. Secondly, we did not segregate the records based on clinical priority of the surgical procedures, as clinical commitments and time pressures can have a significant effect on the quality of documentation in such circumstances. However, under no circumstances does this absolve us from our responsibility to maintain and sustain the requisite standards of documentation. Finally, the impact of changeover of trainees on final outcomes cannot be overlooked.

Conclusion

Based on our work, we feel that regular audits of record keeping can lead to an improvement in the standards of this often neglected, but essential scope of our practice. Despite the improvements we have achieved, there is still a vast room for improvement as we still fall short of the outlined standards. Meanwhile, it is equally important not to undermine the fact that sustaining the achieved standards is also going to be a tedious task. It would be interesting to see the effect of EPAS on our outcomes in the upcoming audit planned for late 2018.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of The Queen Elizabeth, Lyell McEwin and Modbury Hospitals.

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