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The tradition of anaesthetic rooms: Best practice or patient risk?

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Abstract

In the United Kingdom (UK), anaesthetic rooms (ARs) are the standard site for induction of anaesthesia. Although advocates of ARs argue that they provide a quiet and comfortable place for patients to be anaesthetised, the competing argument is that ARs create a risk to those patients by transferring them whist they are unconscious and unmonitored. This study focuses on the current use of ARs and the rationale for their inclusion in new theatre design. Itinvestigates decision-making and prioritisation of competing factors in clinical choice.Mixed methods were used to explore perspectives of anaesthetic clinicians and perioperative managers. Two hundred and two consultant anaesthetists from National Health Service Trusts across the East Midlands region of the UK completed an online survey, and17 perioperative managerswere interviewedregarding the incorporation of ARs in theatre design and changing practice. The majority of anaesthetists preferred to induce all types of patients in the AR, except high risk and obese patients. The most important reasons for choosing to induce in the AR were the ‘quiet environment’ and ‘patient experience’, whereas the least important reasons included ‘patient safety’ and ‘efficiency’. For the respondents who preferred to induce in the theatre the primary reason was ‘patient safety’. Manager interviews revealed their belief that the benefit of ARs is based on perception –not evidence. The research findings question the motives for using the AR for standard anaesthesia provision, as both the daily use of, and design considerations for ARs, seem driven by perception and experience, rather than clear and compelling evidence. Anaesthetic practice in the UK may be operating under the pretences of safety and performance, while carrying on with a traditional way of working which may one-day prove to be an unacceptable risk and investment.

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1. Introduction

The use of a separate and adjacent room to operating theatres for the induction of anaesthesia is common practice in the UK.The anaesthetic room (AR) is an institution older than the National Health Service (NHS) itself, as the Ministry of Health recommended construction of ARs for each operating theatre as early as 1937 [1], while the NHS was not established until nine years later. In contrast, a separate induction room stopped being used in the United States, Canada, Australia, and most Scandinavian countries, where anaesthetic induction takes place in the operating theatre [2-4].

Multiplesurveyswere conducted at the turn of the 20thCentury, which evaluated preferences for ARs. A survey of 100 anaesthetists at the 1991 Association of Anaesthesia of Great Britain and Ireland (AAGBI) annual meeting found that 94% of consultants had ARs in most all operating theatres and 96% used them nearly all of the time on routine operating lists [5]. In 2002, a postal survey of 247 anaesthetic departments across the UK found that 96% of respondents reported the AR as the standard site for induction of anaesthesia, and 79% expressed a preference to use the AR [3].

There are several purposes for the ARbesides medical intervention, including the storage of anaesthetic drugs and equipment [5]; location for installation of venous cannulation [6]; and connection of monitoring [7]. However, the most prominent arguments for the use of ARs are for patient experience and efficiency gains. The AR is thought to be a quieter environment where distractions and interruptions can be reduced [8], but also where the patient is saved from possible anxiety from seeing and hearing the set-up of theatres [7]. The experience of paediatric patients is also a consideration, as parents can accompany their child into the AR in order to be present for the start of anaesthesia [5,7].Efficiency of theatres may also be enhanced by utilising ‘doubling up’ or ‘anaesthetic overlap’ of the AR, where a second patient can be prepared for anaesthesia whilst the first is finishing in theatre. This parallel working model was tested and proved beneficial by allowing an additional orthopaedic case to be completed in a 7-hour working day [9].

The benefits of the AR do have associated costs, as the functioning of the AR as a site of anaesthetic induction requires duplicated anaesthetic machines and monitoring equipment, as well as the cost to maintain them [3,5,10].In addition to the financial implications of constructing, equipping, and maintaining a separate room for anaesthesia, the practice also results in the transfer of an unmonitored, unventilated, and unconscious patient from the AR to the operating theatre (OT). The period just following induction has the risk of anaphylaxis, severe hypotension, and cardiac arrest for the patient [11]. An observational study of 80 patients being transferred from the AR to the theatre found a median disconnection time of 54 seconds, with a drop in arterial oxygen saturation of the patient [4]. It is understood that this transfer time may be a patient safety risk. One account from 1990 attributed the disconnection of the anaesthetised patient and transfer to the theatre, among other errors, as the causes of an accidental death [12].

Aims andobjectives

The purpose of this study was to explore the role of anaesthetic rooms in current anaesthetic practice and the decision-making surrounding when and how they are used, and for which reasons. The objectives of the study are as follows:

- Determine consultant anaesthetist preferences for the use of ARs.
- Investigate the rationale behind clinical choice to use ARs.
- Explore management decision-making in regards to theatre design.

2. Methods

This study was approved by the University of Nottingham, Faculty of Engineering Ethics Review Committee (Date 22/05/14, Sponsor Reference 14006). A mixed methods research approach was used to investigate the reasoning, decision-making, and priorities of two groups for the use of ARs: consultant anaesthetists and perioperative managers.

Online survey of consultant anaesthetists

An online survey was created using the Bristol Online Survey (www.survey.bris.ac.uk) web survey development service and distributed via email to consultant anaesthetists within 9NHS Trustswithin the East Midlands by a local collaborator based in each Trust. The survey was anonymous and took approximately 10 minutes to complete. It consisted of 22 questions requiring a mix of categorical and open response.The survey was launched on 22nd July 2014 and was closed on 31stDecember 2014. Descriptive statistics, bivariate, and multivariate analyses were conducted using SPSS Statistics 22 software (IBM Corporation). Open response questions were coded and analysed using NVivo 10 software (QSR International).

Phone interviews with perioperative managers

Perioperative (anaesthetic, theatre, and business) managers or directors who oversaw the operating theatres were invited by the local collaborator in their respective Trusts to participate in a 30-45 minute semi-structured interview discussing the use of anaesthetic rooms and the decision-making surrounding their continued incorporation in design of theatres.Both clinical and business managers were included in the study to provide various perspectives on theatre design, as all managers interviewed would be part of the theatre design process in any new build or renovations. Recruitment took place in 8 NHS Trusts and 1 private treatment centre in the East Midlands region of the UK. Interviews were conducted by phone with interviews digitally recorded and transcribed verbatim for thematic analysis and coding using NVivo 10 software.

3. Results

Current anaesthetic practice

Two hundred and two consultant anaesthetists participated in the survey, of which 91 (45%) also practiced in the private sector and 94 (46.5%) worked or trained in anaesthesia outside of the UK. The majority of respondents (81) had been qualified as consultant anaesthetists for between 5-14 years, the remaining ranged from less than 5 to 34 years of consultant experience. An overwhelming majority of respondents (99%) had anaesthetic rooms adjacent to their operating theatres, with 97.5% indicatingthat all or almost all of the theatres had a corresponding AR.An equal percentage (97.5%) of respondents indicated that most patients were induced for surgery in the AR.In comparison, 100% of the respondents who practice in the private sector (n=74) induced most patients in the AR.

Typical activities taking place in the AR included: initiation of both standard and invasive monitoring (e.g. arterial and central lines), World Health Organizationchecks, storage of supplies, team (de)briefing, communication with patient/family, regional and general anaesthesia provision. Other uses indicated by the survey included surgical preparation of the patient for orthopaedic surgery, anaesthetic drug preparation, teaching of trainees, and avoidance of radiation. Surprisingly, 8 anaesthetists reported using the space for lunch or refreshments due to a lack of coverage for breaks.

3.1.1. Patient specific considerations

The decision to use the anaesthetic room or the operating theatre as the site of induction varied based on the type of patient being treated. Table 1 describes the frequency of preference for each patient type. The high risk category was included to incorporate any other risk factors that may be present. Anaesthetists expressed preference to induce high risk patients in the theatre who had haemorrhages, abdominal aortic aneurysms (AAA), or obstetric patients, where the time between induction and knife-to-skin should be minimised. Additionally, 58.4% of respondents preferred inducing morbidly obese patients in the theatre, which was explained as an effort to avoid difficulties in transferring the patient from the trolley or bed to the operating table.

Table 1.Preference for site of induction based on patient typeby number of respondents (%).

	Type of Patient						
Site Preference	Elderly	Paediatric	"Standard" Adult	Anticipated Difficult Airway	Emergency	High Risk*	Morbidly Obese
Anaesthetic Room	143 (70.8%)	177 (87.6%)	148 (73.3%)	138 (68.3%)	95 (47.0%)	56 (27.7%)	66 (32.7%)
Operating Theatre	27 (13.4%)	3 (1.5%)	21 (10.4%)	52 (25.7%)	73 (36.1%)	129 (63.9%)	118 (58.4%)
No Preference	32 (15.8%)	22 (10.9%)	33 (16.3%)	12 (5.9%)	34 (16.8%)	17 (8.4%)	18 (8.9%)

*The patient type, 'high risk', was not defined for the anaesthetists, allowing them to respond intuitively. Although difficult airway, morbidly obese, and emergency patients will also be considered high risk, the category allows a coverall for any other high risk patients, such as ones with cardiovascular instability.

3.1.2. Factors influencing site of induction

Consultant anaesthetists were asked to indicate their associated level of importance for each factorin the choice to anaesthetise in the AR or in-theatre on a scale of Unimportant (0), Of Little Importance (1), Moderately Important (2), Important (3), and Very Important (4). All 202 respondents indicated importance forthe reasons to induce in the AR; however, a varied response rate, ranging from 154 to166, resulted for the reasons to induce in-theatre. This could be due to the fact that respondents did not know how to evaluate each factor, or because they did not routinely use the AR for induction for their specialties and could not specify why. Although an option was available for 'No AR' in the questions evaluating reasons to choose to induce in-theatre (as the lack of an AR would eliminate the need to choose to induce in-theatre), respondents did not consistently answer all questions. The largest amount of respondents (166) for factors influencing the choice to induce in-theatre responded to *patient safety*.

A Friedman test was conducted for all reasons to induce in the AR, in order to determine if any significant differenceexisted amongst the factors forthat decision.This was also applied to the reasons to induce in-theatre. Both tests resulted in a p-value of .000, presenting significant difference in importance for some factors. In each group of factors (either AR or OT), bivariate analysis was conducted for each factor against the others, using the Wilcoxon signed rank test (adjusted with the Bonferroni correction), shown in Table 2 and 3, in order to determine significance of differing importance ranking. The descriptive statistics for the responses are shown in the Appendix.

For the reasons to choose to induce in the AR, a *quiet environment* and *patient experience* were more often ranked of higher importance than other factors. In contrast, of the 6 possible factors included in the survey, *patient safety*, *personal preference*, and *efficiency* were ranked of lower importance than the other factors. The leading free response from the survey regarding the usefulness of the AR described it as a quiet environment, preferable over the noisy theatre environment where theatre staff are chatting or setting up instruments in a loud fashion.

The choice to induce in-theatre based on *patient safety* was most often ranked as the most important factor to choose to induce in the operating theatre, followed by both *inadequate space in the AR* and *personal preference*. Inadequate space in the AR was most frequently rated as either Unimportant or Very Important, demonstrating the variation in anaesthetist satisfaction with the size of existing ARs. Free response answers supported these findings, as the reduction of patient transferring and handling and patient safety were the leading explanations for choice to induce in-theatre. Additional responses related to the type of patients to be induced in theatre (e.g. sick, emergency, obese, AAA, neonates, obstetrics, etc.) for safety purposes. Maintenance of continuous monitoring, the cost of duplicated equipment in the AR, and the size of the AR were also frequently reported considerations.

Table 2.P-value table of factors for choosing to induce in the anaesthetic room, based on the Wilcoxon signed rank test.

Reason to induce in the anaesthetic room	Quiet environment	Patient experience	Teaching & communication	Patient safety	Personal preference	Efficiency
Quiet environment	-	.070	.000*	.000*	.000*	.000*
Patient experience (e.g. anxiety)	.070	-	.000*	.000*	.000*	.000*
Teaching & communication	.000*	.000*	-	.043	.011	.001*
Patient safety	.000*	.000*	.043	-	.957	.355
Personal preference	.000*	.000*	.011	.957	-	.232
Efficiency	.000*	.000*	.001*	.355	.232	-

* P ≤ .0033, significant to the 0.05 level after Bonferroni correction

Table 3. P-value table of factors for choosing to induce in the operating theatre, based on the Wilcoxon signed rank test.

Reason to induce in-theatre	Patient safety	Inadequate space in AR	Personal preference	Patient experience	Efficiency	Insufficient equipment in AR	Insufficient staffing to utilise the AR	Noise or disruption in AR
Patient safety	-	.000†	.000†	.000†	.000†	.000†	.000†	.000†
Inadequate space in AR	.000†	-	.546	.000†	.000†	.000†	.000†	.000†
Personal preference	.000†	.546	-	.000†	.000†	.000†	.000†	.000†
Patient experience	.000†	.000†	.000†	-	.784	.255	.021	.000†
Efficiency	.000†	.000†	.000†	.784	-	.250	.067	.002
Insufficient equipment in AR	.000†	.000†	.000†	.255	.250	-	.449	.017
Insufficient staffing to utilise the AR	.000†	.000†	.000†	.021	.067	.449	-	.165
Noise or disruption in AR	.000†	.000†	.000†	.000†	.002	.017	.165	-

† P ≤ .0018, significant to the 0.05 level after Bonferroni correction

Using the same non-parametric tests, the importance was evaluated for multiple potential influences that may help to change the current site of induction. *Feedback from patients* and *infrastructure modifications (e.g. AR construction or demolition)* were more often indicated as of higher importance than other influences. Guidance from professional bodies, such as the Royal College of Anaesthetists (RCA) and the AAGBI were of greater importance than policy (e.g. national, organisational, and departmental). The influence with the least importance was most often *peer opinionand practice*. The need to physically alter the existing infrastructure in order to modify practice is explained by a strong resistance to change, as 179 (88.6%) consultants did not want the site of induction changed.

Management perspective

Interviews were conducted with 17 perioperative managers and directors: 4 theatre, 5 business/general, and 8 anaesthetic.Questions assessed management knowledge of the use of ARs, and elicited responses to questions regarding the design of theatres, and the decision to include or exclude ARs in future builds or renovations.

3.2.1. Defining best practice

Managers frequently used the term ‘best practice’ when referring to either national guidance or literature, particularly literature that describes successful ways of working from other hospitals within the UK and abroad.The interview participants lacked any specific knowledge of research or guidance pertaining to AR use in anaesthetic practice, and inferred that consultant anaesthetists would be up-to-date on current guidelines and recommendations.References to seeking advice from journal publications or benchmarking from practice of other Trustswas strictly theoretical, as although most managers valued it, they either admitted to not evaluating literature, or placed the responsibility on others, stating “they” would investigate the existing literature and guidelines. In questioning the foundations for AR induction, managers referred to tradition as the dominant factor.

"It could be a historical reason that they're used, or I don't know whether there's any research to show that it's better to take the patient straight to theatre. I don't know the answer to that."(Participant 3)

"I shouldn't think anybody's looked at any literature. A lot of use of ARs is based on tradition rather than evidence, I'd say."(Participant 5)

The themes of tradition and culture as key drivers of current anaesthetic practice were prevalent from most participants. The prominent assumption that the longstanding tradition of AR use is deeply engrained in all anaesthetists who have been trained or work within the UK may possibly undermine the relevance of 'best practice' as defined by innovative trials and guidance. National guidance as a detriment to change was also discussed as a few managers stated that a part of the culture of the NHS is top-down management, and suggested the frequency of national guidance and guidelines being publishedcauses fatigue and delayed response to calls for change. However, most managers expressed a high level of trust in guidance produced from professional bodies or the Department of Health, as these would presumably be strongly rooted in evidence.

"I think national guidance has got a very strong role if it's a risk and safety issue. And I would expect that if there was strong evidence that continuing to use ARs was a genuine risk to patient safety, that we would very rapidly see guidance from the Royal College of Anaesthetists and the Association of Anaesthetists." (Participant 1)

3.2.2. Experience as evidence

Management support for the continuanceof AR existencein new design focused primarily onefficiency and patient experience and safety.While these organisational objectivesemerged from participants' stories, their praise for ARs brings to question the legitimacy of experience as the main director of clinical choice, as most rationale for the induction of patients in the AR came from anecdotal evidence.

Interview coding highlighted several references to efficiency, productivity, throughput, utilisation, and financial benefits from increasing the number of cases done in a day. All managers explained the benefit of 'doubling up' or achieving 'anaesthetic overlap', where the AR can be used to reduce delays between cases. Most managers, however, only supported these findings with their own experiences or those of their clinical colleagues.Participants were also prompted to reflect on how frequently overlap is possible, which is not always due to staffing.

"I wouldn't say it was evidence-based in any way. Anecdotally, it's intuitive really that you could improve efficiency by using two rooms rather than one, when you've got enough staff… It's the way people are trained to work in this country. You know, there's no reason to change that, because there's no evidence we've been shown to change that." (Participant 12)

"So, I cannot take a peer reviewed article and say, 'Look, here's the evidence that ARs are a good idea.' But what I can do is say, my experience tells me that for things like efficiency, turnover times, confidentiality, patient dignity, and things like that, having an AR is a good idea."(Participant 9)

In relation to factors impacting the patients themselves, patient experience was referenced more often than patient safety. The factors for choosing to use the AR, as seen in the survey results, are not based on safety, but factors pertaining to comfort and control of anaesthetists, and perceived improved experience for patients.

"I think people perceive from a patient's perspective, it's a more pleasant environment to go into and be given your anaesthetics than if you went directly into main theatre, but I don't know of any evidence that actually says that's real. I think that's probably just perception." (Participant 1)

In reference to the challenges of changing the site of induction to the OT, one participant reiterated the importance of safety over patient, or staff, experience.

"You might make it an environment people feel innately less comfortable with, you may affect other things, but I think you know, in general most colleagues would say if they're concerned about a patient, then the safest option is to anaesthetise in theatre anyway." (Participant 1)

4. Conclusion

The results of this research demonstrate thatanaesthetic decision-making errs on the side of safety for high risk patients –forgoing the AR and anaesthetising directly in theatre when the patient may be at risk from delayed transfer and disconnection of monitoring. The reasoning to use the AR is highly supported by prioritising the quietness of the environment, which some anaesthetists link to safety by reducing distraction during induction. The patient is at the heart of the rationale, as anaesthetists believe that patients feel anxious or intimidated by the OT

environment. Yet, this 'patient experience' is overridden by clinical decision-making in the case of obstetrics or other at risk patients.

The role of management in the continued use of ARs is a strong one, as they are the individuals who would have the power to make hospital-planning decisions for the future of surgery in the UK, alongside architects and estates managers. However, the reality of management decision-makingis that they do not generally have first hand knowledge of the evidence for AR use. If clinical input to theatre design is then left to the consultant anaesthetists, 'best practice'may then be based on personal experience, anecdotal evidence, and the overwhelming consensus of tradition.

In the example of inducing anaesthesia in the AR, the majority of anaesthetists interviewed have agreed to allow for the slight risk to patients. The concept of safety is constructed by the anaesthetists, as "meanings of risk, especially for clinicians, reflect localized concerns and issues, as well as collective beliefs about professional responsibility and jurisdiction"[13].Although it is known that the time just after induction of anaesthesia is a dangerous one, the continuance of a practice that some consider a compromise to patient safety is a calculated risk that the majority of UK anaesthetists take on a regular basis and have the power to determine when it is appropriate.

The tradition of ARs is engrained in the majority of anaesthetists from training and current practice, however, the infrastructure of theat timesold NHS theatres also reinforces that practice. In addition, the norms of practice for surgeons, nurses, operating department practitioners, and auxiliary workers have adapted to the existing infrastructure, thereby adding further barriers to changing behaviours. As managers look to a consensus decision from the consultant anaesthetists and theatre staff to help inform design of theatres, the underpinnings of the status quo are powerful and only strong and compelling evidence can change that. On the other hand, if the continued existence of ARs is based only on tradition and a dubious experiential evidence-base, it may be time to reassess if it is truly a risk worth taking.

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Appendix A. Descriptive statistics for factors influencing the preferred site of induction

Reason to induce in the **anaesthetic room**	Unimportant	Of Little Importance	Moderately Important	Important	Very Important	Mode (%)	Median (IQR)	Sample Size
Quiet environment	9 (4.5)	5 (2.5)	25 (12.4)	69 (34.2)	94 (46.5)	4 (46.5)	4 (3-4)	202
Patient experience (e.g. anxiety)	4 (2.0)	14 (6.9)	29 (14.4)	69 (34.2)	86 (42.6)	4 (42.6)	4 (3-4)	202
Teaching & communication	14 (6.9)	18 (8.9)	45 (22.3)	72 (35.6)	53 (26.2)	3 (35.6)	4 (2-4)	202
Efficiency	24 (11.9)	31 (15.3)	41 (20.3)	65 (32.2)	41 (20.3)	3 (32.2)	3 (1-3)	202
Personal preference	15 (7.4)	33 (16.3)	45 (22.3)	64 (31.7)	45 (22.3)	3 (31.7)	4 (2-4)	202
Patient safety	26 (12.9)	31 (15.3)	29 (14.4)	59 (29.2)	57 (28.2)	3 (29.2)	4 (1-4)	202

Reason to induce **in-theatre**	Unimportant	Of Little Importance	Moderately Important	Important	Very Important	Mode (%)	Median (IQR)	Sample Size
Patient safety	11 (6.6)	3 (1.8)	13 (7.8)	35 (21.1)	104 (62.7)	4 (62.7)	4 (3-4)	166
Inadequate space in AR	34 (21.5)	26 (16.5)	32 (20.3)	32 (20.3)	34 (21.5)	0,4 (21.5)	1 (0-3)	158
Personal preference	32 (20.5)	24 (15.4)	40 (25.6)	38 (24.4)	22 (14.1)	2 (25.6)	2 (1-3)	156
Patient experience	49 (31.8)	34 (22.1)	39 (25.3)	13 (8.4)	19 (12.3)	0 (31.8)	1 (0-2)	154
Efficiency	53 (33.3)	40 (25.2)	21 (13.2)	29 (18.2)	16 (10.1)	0 (33.3)	1 (0-3)	159
Insufficient equipment in AR	64 (41.3)	37 (23.9)	13 (8.4)	22 (14.2)	19 (12.3)	0 (41.3)	1 (0-3)	155
Insufficient staffing to utilise the AR	72 (46.8)	31 (20.1)	18 (11.7)	17 (11.0)	16 (10.4)	0 (46.8)	1 (0-2)	154
Noise or disruption in AR	80 (51.6)	36 (23.2)	11 (7.1)	14 (9.0)	14 (9.0)	0 (51.6)	0 (0-2)	155

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