IMPACT OF ATTRIBUTED AUDIT ON PROCEDURAL PERFORMANCE IN CARDIAC ELECTROPHYSIOLOGY CATHETER LABORATORY

Short Title: Attributed Audit in Clinical Practice

Sawhney V[1], Volkova E[1], Shaukat M[1], Khan F[1], Segal O[1], Ahsan S[1], Chow A[1], Ezzat V[1], Finlay M[1], Lambiase P[1], Lowe M[1], Dhinoja M[1], Sporton S[1], Earley MJ[1], Hunter RJ[1], Schilling RJ[1]

[1] Department of Cardiology, Barts Heart Centre, London

Corresponding Author:

Dr Vinit Sawhney

EP Cardiac Research

1 SMLG, 2nd Floor East Wing

St Bartholomew's Hospital, London EC1A 7BE

Tel: 44 203 76 58682

Fax: 44 203 465 6483

Email: sawhneyvin@googlemail.com

ABSTRACT

Purpose: Audit has played a key role in monitoring and improving clinical practice. However, audit often fails to drive change as summative institutional data alone may be insufficient to do so. We hypothesised that the practice of attributed audit, wherein each individual's procedural performance is presented will have a greater impact on clinical practice. This hypothesis was tested in an observational study evaluating improvement in fluoroscopy times for AF ablation.

Methods and Results: Retrospective analyses of fluoroscopy times in AF ablations at the Barts Heart Centre (BHC) from 2012–2017. The concept of attributed audit was introduced in 2012 at St Bartholomew's Hospital (SBH). This resulted in a significant drop in fluoroscopy times (33.3±9.14 to 8.95±2.50, $p<0.0001$) from 2012-2014. In order to test whether this was related to improvements in clinical practice rather than technology alone, this concept was introduced to a second group of experienced operators from the Heart Hospital (HH) as part of a merger of the two institutions in 2015. A significant difference in fluoroscopy times between operators from the two centres was seen in 2015. Each operator's procedural performance was shared openly at the audit meeting. Subsequent audits showed a steady decrease in fluoroscopy times for each operator with the fluoroscopy time (min, mean±SD) decreasing from 13.29±7.3 in 2015 to 8.84±4.8 ($p<0.0001$) in 2017 across the entire group.

Conclusions: Systematic improvement in fluoroscopy times for AF ablation procedures was noted by evaluating individual operators' performance. Attributing data to physicians in attributed audit can prompt significant improvement and hence should be adopted in clinical practice.

Keywords: attributed audit, clinical practice, quality improvement, electrophysiology catheter laboratory

INTRODUCTION

Cardiac electrophysiology (EP) procedures have grown significantly in number in the last few decades. Catheter ablation for atrial fibrillation (AF) has become one of the most commonly performed procedures by electrophysiologists. With rapidly evolving technology it has evolved from being an investigational procedure to a first line therapeutic option in the management of AF. [1] Like any other surgical specialty, audit should play a key role in informing and improving cardiac EP practice. Whilst published consensus guidelines[1] provides a benchmark for these clinical audits, institutional and national registries help determine real-world outcomes in clinical practice which informs the audit process.

Clinical audit is one of the major quality improvement processes within the National Health Service (NHS) in the UK. It is a systematic process that seeks to improve patient care against explicit criteria. Where indicated, changes are implemented and further monitoring is used to confirm improvement in healthcare delivery. Although audit remains central to quality improvement within the NHS, the evidence for it being an effective strategy for improving practice is weak.[2] Audit, as a tool, has often failed because it has not brought about change and improvement.[3] One possible reason for this is that summative institutional data alone may be insufficient to change individual physician behaviour.[4,5] More recently, some surgical specialties have published individual surgeon-specific outcome data to promote greater transparency within the NHS to improve standards and patient safety.[6] There are no data to confirm whether this has influenced outcomes.

We hypothesised that the practice of attributed audit, wherein individual specific procedural performance is presented in a forum to all clinical staff, will improve clinical practice. We tested this hypothesis using fluoroscopy times for AF ablation as an objective and easily measured parameter from a large-scale institutional registry. We examined the impact of attributed audit on two cohorts of physicians - a control group and an experiment group (joining the clinical practice of the control group) as part of a large hospital merger.

METHODS

Study Design

We performed a cross-sectional analysis of patients undergoing AF ablation at Barts Heart Centre (BHC) from 2012 – 2017. Fluoroscopy times for each operator performing AF ablation were recorded and used as a surrogate for impact of attributed audit on clinical practice. Prior to the procedure, all patients gave written informed consent. This audit met criteria for operational improvement activity exempt from ethics review.

Study Setting and Sample

We collected procedural data over five years from AF ablation carried out by 14 electrophysiologists from two tertiary hospitals in London, St Bartholomew's Hospital (SBH) (control group) and the Heart Hospital (HH) (experiment group). These two institutions merged in 2015 to form the Barts Heart Centre (BHC). All data were collected from a dedicated AF ablation registry, which is maintained by the audit department at St Bartholomew's hospital.

In order to improve clinical practice and to reduce variation between operators, attributed audit was introduced. Attributed audit involves the presentation of individual operators' procedural parameters and outcomes in an open forum for all departmental staff. Prior to this all data had been anonymised so that individual operator performance was not available to any staff other than the physician involved and the person preparing the audit. Attributed audit was introduced to the control group (SBH) in 2012. A series of audits were made each year and these included auditing procedure and fluoroscopy times, complications, time to discharge, freedom from arrhythmia on follow-up and need for repeat procedures. Although data were summarised on a monthly basis, the cumulative results were presented twice a year in the audit meeting. The performance of physicians and variation in practice was monitored annually. Any changes in practice and performance could have been explained by improvements in technology. Therefore when SBH and HH merged in 2015 we examined the impact of attributed audit on the HH physicians practice. Prior to this merger the physicians at HH carried out

anonymised audits. Since 2015, objective evaluation of each individual operator's performance was carried out and discussed at an open forum. Fluoroscopy time during AF ablation was used as the discrete end-point to measure the impact of attributed audit on each operator's performance. For the purposes of this study, physicians performing less than 20 AF ablations per year were excluded to ensure meaningful statistical comparisons.

Fluoroscopy in Catheter Ablation Procedure

All catheter ablation procedures for AF, both cryoballoon and radiofrequency ablation were included. Operator preference determined the technique and approach including pulmonary vein isolation with or without additional substrate modification.

Electroanatomic mapping systems used for radiofrequency ablation included Ensite NavX and CARTO. These have evolved during the study period and could have had an impact on the fluoroscopy times. However, this is applicable to the early part of the study period (2012 - 2014) and hence the impact of attributed audit was re-examined post merger in 2015 when a new group of electrophysiology consultants (HH) were introduced to this practice.

Intervention – Attributed Audit

The concept of attributed audit was introduced at St Bartholomew's Hospital (SBH) in October 2012. We examined the impact of attributed audit on clinical practice by assessing the changing trends of fluoroscopy times (for individual operators) in AF ablation procedures over six years (2012 – 2017). We were able to further examine the impact of physician exposure to attributed audit from 2015 when SBH and Heart Hospital (HH) merged to form the Barts Heart Centre (BHC). Although audit had been an integral part of clinical practice at both institutions prior to this merger, the audit at HH had been anonymised with only the physicians' themselves being aware of their data. At SBH, all data were presented in an open forum and attributed to the individual physician since 2012.

Data were collected for each individual operator and recorded in the departmental AF ablation registry. All operators agreed a process for collecting and presenting the data prior to the implementation of open audit. In

case of a disagreement, a majority vote was used to settle this. All senior clinicians signed up to and were strong advocates of this process. Individual results were presented and each operator's procedural performance was discussed in the departmental audit meetings. All senior physicians, training grade doctors (specialist registrars and clinical fellows), catheter lab and cardiac ward nurses and cardiac physiologists involved in the procedures were present at these meetings.

Results were presented for each operator so that they and everyone else in the department could compare their performance with that of their peer-group. This was followed by a group discussion led by the audit lead at which electrophysiologists, trainees, nursing staff and physiologists had the opportunity to discuss the existing outcomes and ways to improve existing practice. No judgement was made on the data and comments on the results were also discouraged other than by clinicians referring to their own data. Only the data were presented at the audit meeting and this was stimulus enough for clinicians to examine their own practice. A report summarising the attributed audit findings was made available on the department intranet and the main learning points were circulated to all clinical staff in the electrophysiology department by the audit lead.

Facilitated Action Planning

In addition to the attributed audit presentation and summary report, physicians whose procedural data were outside the normal range were given the opportunity to discuss this outside the audit. This was done in a formal meeting with their colleagues outside of the departmental meeting. They were also given the opportunity to join other colleagues to observe their procedural practices in order to evaluate how they could change their practice to improve upon their audit results. Neither of these was obligatory.

End Points

The primary end point of the study was fluoroscopy times (during AF ablation) for each operator before and after the introduction of attributed audit.

Statistical Analyses

Data were analysed using SAS version 9.3, statistical software. Continuous data were presented as mean ± standard deviation or median (range) if not normally distributed. Categorical data were reported as a percentage. Continuous data were compared using unpaired t-test (if normally distributed) and Mann-Whitney U test if not normally-distributed. Categorical data were compared using chi-square test. A p-value < 0.05 was considered significant.

RESULTS

2414 AF ablation were performed over five years (2012 - 2017) at St Bartholomew's Hospital (Barts Heart Centre). During this period a total of 14 experienced operators carried out these procedures. There were no significant differences in the total number of procedures performed by each operator over the study period. Those performing less than 20 AF ablations per year were excluded from the study. The average number of procedures per year for each physician was 63, 50, 63, 52, 70 and 59 for SBH1 – SBH6 and 41,40,39,45,44,40,38 and 36 for HH1 – HH8 respectively.

Mean fluoroscopy times (min) for all AF ablations performed per year for each operator are shown in Figure 1. These include physicians from St Bartholomew's hospital (SBH1 - SBH6) and Heart Hospital (HH 1- HH8). Fluoroscopy times for SBH physicians are available from Jan 2012 – Sep 2017 and for HH physicians from May 2015 – Sep 2017. There was a significant drop in the mean fluoroscopy time (min, mean ± SD) for the entire group (SBH) from 2012 - 2014 (33.3 ± 9.14, n=306 to 8.95 ± 2.50, n=363 p-value 0.0001). Moreover, significant decrease in fluoroscopy times (min, mean ± SD) for each operator were noted over time (2012 – 2014; SBH 1: 20.30 ± 10.8 to 6.13 ± 2.43 mins, SBH 2: 33.80 ± 15.16 to 11.71 ± 7.69 mins, SBH 3: 40.60 ± 10.12 to 7.74 ± 5.31 mins, SBH 4: 38.60 ± 17.94 to 2.05 ± 2.4 mins, SBH 5: 10.64 ± 9.4 to 6.12 ± 5.85 mins, SBH 6: 16.08 ± 14.52 to 7.34 ± 6.88 mins) – Figure 1.

There was a significant difference in the fluoroscopy times between the HH and SBH physicians at the time of the merger. The fluoroscopy time (min, mean ± SD) for AF ablations for the HH and SBH physicians in 2015 was 18.50 ± 4.76 and 6.33 ± 2.29 (p-value 0.0001) respectively. The case-mix and

technology used was the same among the two groups. In keeping with the attributed audit practice at SBH, individual operator results were reported and 4 out of the 14 operators (29%) were identified as high users of fluoroscopy. Their practices were examined and feedback and support offered.

Following the open audit, a reduction in fluoroscopy times for each operator was seen – Figure 1. The fluoroscopy time (min, mean ± SD) for AF ablations amongst the HH and SBH physicians in 2017 was 11.75 ± 2.99 and 5.44 ± 4.35 respectively. This represented a significant drop in fluoroscopy time amongst the HH electrophysiologist cohort (18.50 ± 4.76 to 11.75 ± 2.99, p-value 0.001). A steady reduction in fluoroscopy use was observed for all electrophysiologists from 2015 to 2017 with the mean fluoroscopy time decreasing from 13.29 ± 7.3 in 2015 to 8.84 ± 4.8 min (p=0.0001) in 2017 - Figure 2.

Moreover, a univariate analyses was carried out to look for any correlation between procedure and fluoroscopy times for all procedures carried out in 2016 – 2017. The mean procedure and fluoroscopy times for the entire cohort over the two years were150.71 ± 22.71 and 9.23 ± 5.52 respectively. There was no significant association between the procedure time and fluoroscopy time, p = 0.139.

DISCUSSION

The present study shows that adopting a model of attributed audit helps in objective measurement of individual operators' procedural performance. This translates to an immediate change in clinical practice, which can lead to significant improvement in procedural performance.

Adopting the approach of attributed audit wherein individual operator results were made visible, we saw a clear decrease in fluoroscopy time for each operator (SBH1 - SBH4) from 2012 – 2014. In order to address the potential that technological developments may have influenced these results we had the unique opportunity to compare two cohorts using the same technologies and then assess the impact of attributed audit as the result of a merger of two institutions. Although historical data for individual operator fluoroscopy times (2012 - 2014) was not available for the HH physicians, a

significant difference in fluoroscopy times between the groups was seen at merger. Higher fluoroscopy times amongst the HH cohort could partly be attributed to a lesser drive to achieve low fluoroscopy times per case due to newer equipment (and hence less radiation exposure) available to this group at their institution. Nevertheless, it was seen that the difference in fluoroscopy times between the groups became smaller as clinical practice was influenced by exposure to attributed audit.

We believe that the improvement is a direct result of effective performance feedback, which is undoubtedly a key facilitator of medical engagement in open audit. A lack of medical engagement is known to represent a significant barrier to quality improvement within NHS England.[7,8] Effectively engaging physicians in the process of attributed audit ensures that it becomes a promoter of continuous improvement within a service. Interventions that increase intensity of feedback have been shown to increase intention to comply with audit criteria[9]. Audit results were reported for individual operators in the form of an oral presentation at the departmental audit meeting. These were reinforced by means of a written report summarising key objectives and facilitated action planning wherein “high fluoroscopy users” had the opportunity to discuss their practice and join colleagues for procedures to learn alternate ways of improving practice. One important factor in this was to ensure that such presentations and training opportunities were offered in a collaborative environment rather than in a confrontational style. This allowed all participants the positive experience of learning and improving rather than focusing on the negative aspects of this experience that the process had the possibility to engender.

Lastly, the role of a dedicated AF ablation registry in this study remains invaluable. It is a key component of the audit process as it helps determine real-world outcomes on an institutional and individual operator level. Although the registry serves various purposes, it is particularly useful to evaluate temporal trends in procedural performance in cardiac electrophysiology.

Our results suggest that the practice of attributed audit and open presentation of each operator’s procedural performance is key to clinical quality improvement. It enhances medical engagement on an individual basis,

which helps tackle one of the most challenging aspects of the audit process i.e. bringing about change.

CONCLUSIONS

Engaging in the practice of attributed audit leads to objective measurement of an individual operator's procedural performance. Presenting this at an open platform translates into implementing immediate change in clinical practice. The concept of attributed audit is key to bring about a systematic improvement of healthcare and improving standards of care within the NHS.

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COMPETING INTERESTS

None

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Cost-neutral study

CONTRIBUTORSHIP

VS: data collection, data analyses, manuscript draft and preparation; EV: data collection, MS: data collection; FK: manuscript review; OS: manuscript review; SA: manuscript review; AC: manuscript review; VE: manuscript review; MF: manuscript review; PL: manuscript review; ML: manuscript review; MD: manuscript review; SS: manuscript review; MJE: manuscript review; RH: supervised data collection, manuscript review; RJS: study concept and design, initiated open audit in trust, supervised data collection and manuscript draft, manuscript review.

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FIGURE LEGENDS

Figure 1: Fluoroscopy times for individual operators (St Bartholomew's hospital SBH1 - 6 and Heart Hospital HH1 - 8)

The dot plot shows individual operator fluoroscopy times (min, mean) for both SBH and HH operators. The SBH cohort was introduced to attributed audit in 2012 following which decrease in fluoroscopy times for each operator was seen. A clear difference in fluoroscopy times between the HH and SBH operators was seen at the time of merger in 2015. Subsequent reduction in fluoroscopy times in both cohorts was seen with this concept being introduced to the HH cohort (experiment group).

Figure 2: Mean fluoroscopy times at BHC before (2015) and after (2017) the introduction of attributed audit

The box-plot shows fluoroscopy times (min, mean ± SD) for al operators at the time of merger of HH and SBH in 2015 and subsequent significant reduction in fluoroscopy times (2016 and 2017) following introduction of attributed audit to the whole group.

FIGURES

Figure 1: Fluoroscopy times for individual operators (St Bartholomew's hospital SBH1 - 6 and Heart Hospital HH1 - 8)

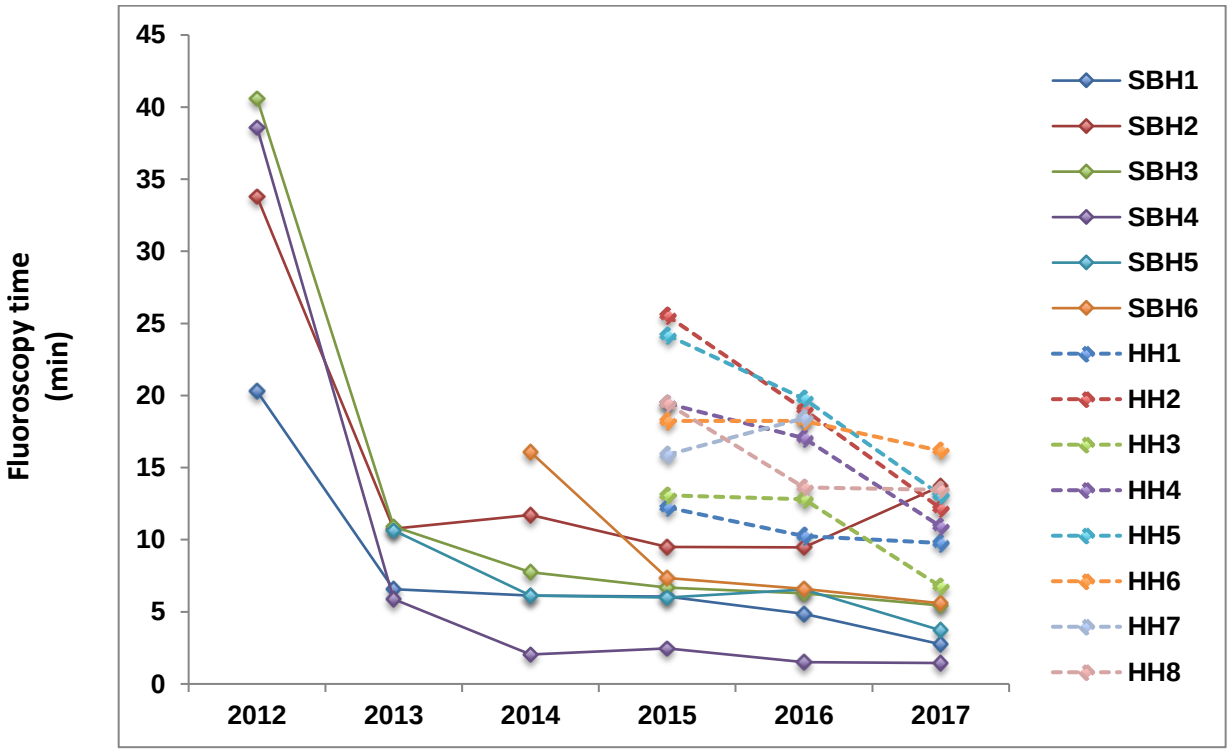

Figure 2: Mean fluoroscopy times at BHC before (2015) and after (2017) the introduction of open audit