

Induction Based Training leads to Highly Significant Improvements of Objective and Subjective Suturing Ability in Junior Doctors

K McGarry¹, MD; G Bradley², MD; S McAllister³, MD;

¹Department the Emergency, Royal Victoria Hospital Belfast, N. Ireland

²The University of Alberta, 116 Street and 85 Avenue, Canada

³Department of Plastic and Maxillofacial Surgery, The Ulster Hospital, N. Ireland

Abstract

Background: Simulation based training has shown to be of benefit in the education of medical students. However, the impact of induction based clinical simulation on surgical ability of qualified doctors remains unclear. The aim of this study was to establish if a 60 minute teaching session integrated into an Emergency Medicine speciality induction program produces statistically significant improvements in objective and subjective suturing abilities of junior doctors commencing an Emergency Medicine rotation.

Methods: The objective suturing abilities of 16 Foundation Year Two doctors were analysed using a validated OSATs scale prior to a novel teaching intervention. The doctors then undertook an intensive hour long workshop receiving one to one feedback before undergoing repeat OSATs assessment. Subjective ability was measured using a 5 point likert scale and self-assessed competency reporting interrupted suturing before and after the intervention. Photographs of wound closure before and after the intervention were recorded for further blinded assessment of impact of intervention. A survey regarding continued ability was repeated at four months following the intervention. The study took place on 7/12/16 during the Belfast Health and Social Care Trust Emergency Medicine induction in the Royal Victoria Hospital Belfast. The hospital is a regional level 1 trauma centre that has annual departmental attendances in excess of 200,000. All new junior doctors commencing the Emergency Medicine rotation were invited to partake in the study. All 16 agreed. The group consisted of a mixture of undergraduate and postgraduate medical doctors who all had 16 months experience working in a variety of medical or surgical jobs previously.

Results: Following the teaching intervention objective and subjective abilities in interrupted suturing showed statistically significant improvement ($P > 0.005$). Self-reporting of competency of independently suturing wounds improved from 50% pre intervention to 100% post intervention. At four month follow up responding participants reported continued increase in confidence and independence in interrupted suturing.

Conclusion: This study suggests that induction based teaching is a practical and robust means of producing lasting improvement in the subjective and objective suturing abilities of medical staff commencing Emergency Medicine placements. We would suggest that the results are also translatable to doctors starting other surgical rotations and practical induction based teaching should be considered for all new trainees.

Keywords: INDUCTION TRAINING, SUTURING, OBJECTIVE ABILITY, SUBJECTIVE ABILITY, STRUCTURED ASSESSMENT

Journal of Medical Education Fall 2017; 16(4):239-244

*Corresponding author: Kevin McGarry, Department of Emergency and General Surgery, Craigavon Area Hospital, 68 Lurgan Road, Portadown, Craigavon BT63 5QQ, N. Ireland

Email: kmcgarry10@qub.ac.uk

Introduction

The Royal Victoria Hospital Belfast (RVH) is Northern Ireland's only Level 1 trauma centre. The RVH Emergency Department (ED) has around 200,000 attendances annually, ranging from minor injuries to multisystem trauma (1). During daytime hours, Emergency Nurse Practitioners (ENPs) manage most minor injuries, in a nurse-led unit within the Department. Out of hours, junior doctors, few with formal surgical experience, manage these patients within the main ED.

A pre-study questionnaire identified that confidence managing wounds independently was lowest in the Foundation Year 2 Junior Doctor group (F2) working within the Emergency Department. Previous studies have documented that formal education programs increase objective procedural ability (2, 3) however assessment of outcomes of induction based teaching has not previously been reported.

Based on the pre study findings we implemented a Trust-wide quality improvement project - a 60 minute high impact hands-on teaching session integrated into the Trust's formal induction programme. Our intervention successfully produced a statistically significant improvement in the objective ($P>0.005$) and subjective abilities ($P>0.005$) of the 16 doctors who partook with minimal disruption to working pattern or induction on the day of intervention.

Methods

The study was designed as a prospective cohort study to allow assessment of impact of a novel teaching intervention on the wound management abilities of 16 F2 doctors. The study included both objective and subjective testing, and outcomes were measured on the same population before and immediately after the teaching intervention.

Objective assessment of wound management

was completed through one to one individual assessment using a validated Objective Structured Assessment of Technical Skills (OSATs) scoring system (4), while subjective assessment was completed using a self-reported novel 5 point Likert-type scoring system that was produced specifically for this study (appendix 1). Wound closure was conducted on a uniform 10cm incision on simulated foam. Closure attempts before and after the teaching intervention were completed on the same foam specimen allowing blinded photographic comparison by independent experts following the intervention.

On completion of this initial assessment a structured 15 minute PowerPoint teaching session was given focusing on wounds that commonly present to the ED, suturing technique, and standard aftercare management. The information provided was gathered from current Royal College of Surgery guidelines and delivered with the help of the Emergency Nurse Practitioners. Specific practical areas addressed included initial wound assessment, debridement and washout, as well as selection of sutures and dressings. Doctors were then allotted a further 30 minutes and encouraged to attempt to continue to close the simulated wounds again, under direct supervision. At this stage, we specifically targeted the areas that were assessed in the OSATS scoring system that some had struggled with e.g. correct selection of equipment, appropriate size of suture, and economy of movement. Four months following the teaching intervention participants were sent a survey enquiring as to ongoing perceived competence in wound management.

We adapted our analysis of each data set to match common convention. A paired two tail Student's t-test (5) was used to calculate if our intervention produced statistically significant improvement in objective suturing ability.

In regards to subjective assessment again a paired two tailed student t-test was used to determine statistical difference in confidence in ability in wound management based on

self-reporting on our questionnaire. Finally, in regards to assessing competency in independent wound management McNemar's exact binomial test (6) was applied to the results of this survey to examine the potential association between the teaching intervention and the observed differences in the students' ability to manage wounds independently. McNemar's test was selected as the populations (before and after intervention) were correlated.

Results

A paired, two-tailed Student's t-test was carried out to determine any significant differences between the performance of 16 surgical students (given as a mark out of 40) in their Objective Assessment of Surgical and Technical Skills (OSATS) before and after teaching intervention (table 1). The students were scored on multiple domains pre-determined by the OSATS pro forma and awarded an additional 5 points if they managed to close the wound completely. The test was carried out using GraphPad (GraphPad Software Inc., San Diego, USA) and StatsDirect3 (StatsDirect Ltd, Altrincham,

UK), and the power of the paired t-test was then assessed using StatsDirect3 and GraphPad (StatMate2.00 program).

McNemar's exact binomial test was carried out on the results of the student self-assessment data using GraphPad Prism 7.03 and VassarStats (www.VassarStats.net).

The results of the paired t-test show a highly significant improvement in the students' OSATS result after attending the teaching intervention session, compared to their results accrued before this session ($P < 0.0001$, t stat: 7.6804, α : 0.05). The power of the experiment to detect a smallest average difference between pairs of 3.94 (two-tailed, with $\alpha = 0.05$) was 99%. As the actual mean improvement from pre-teaching intervention results to post-teaching intervention results was 7.06, the experimental design was appropriate to confidently assess any statistically significant difference between the two sets of results.

Participants were asked to complete a subjective self-assessment of surgical skill ability before and after the teaching intervention session, rating themselves on a Likert-type scale from 1-5 on their confidence in assessing wounds, suturing ability and

Table 1: Performance of the 16 participants (given as a mark out of 35) in their Objective Assessment of Surgical and Technical Skills (OSATS), before and after the teaching intervention

Participants	Objective Assessment of Surgical and Technical Skills (OSATS) Before Teaching Intervention (/40)	Objective Assessment of Surgical and Technical Skills (OSATS) After Teaching Intervention (/40)
1	24	25
2	12	24
3	15	22
4	14	23
5	15	23
6	16	22
7	12	23
8	15	25
9	14	25
10	19	23
11	24	28
12	13	25
13	17	24
14	21	24
15	17	24
16	31	32

wound aftercare that we created to measure impact (table 2). Subsequently, the sets of results for pre teaching assessment versus post teaching assessment, for each of these abilities were again compared using paired, two-tailed Student t-tests.

Student self-assessments of whether or not they were confident in their ability to manage wounds independently, before and after teaching intervention, were also compared (table 3). Only 8/16 students thought themselves capable of independently managing wounds before the teaching intervention, whereas all students (16/16) felt that they had this capability

after the teaching intervention (Figure 1). McNemar’s exact binomial test was applied to the results of this survey to examine the potential association between the teaching intervention and the observed differences in the students’ ability to manage wounds independently. We opted to use this test as our data set was both correlated and involved a small sample size.

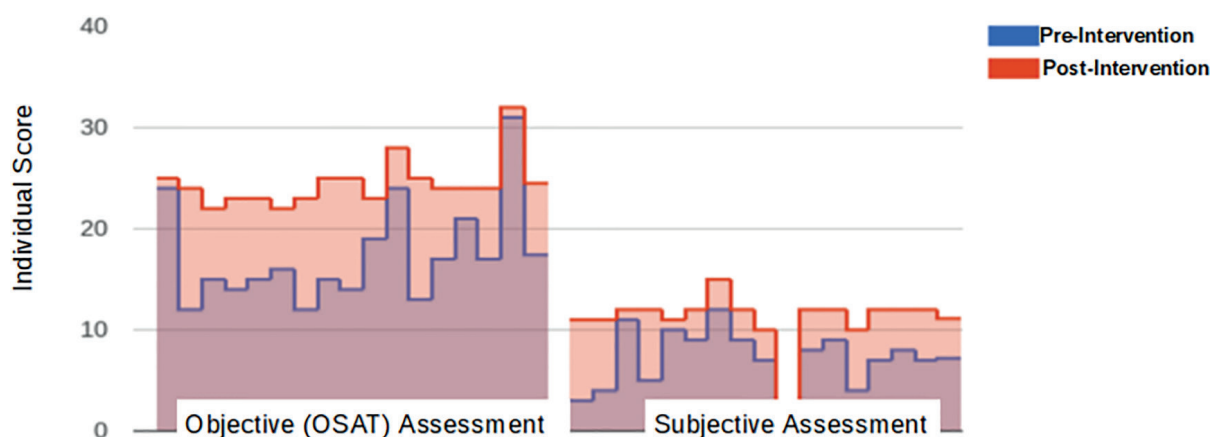
The results showed a significant statistical discrepancy between the expected and observed post-teaching intervention results (P=0.0078), suggesting a strong association between the ability to manage wounds

Table 2: Subjective self-assessment results of 16 participants before and after teaching intervention

Participant	Before/After Teaching	Confidence in wound assessment (out of 5)	Confidence in suturing (out of 5)	Wound aftercare (out of 5)	Independently manage wounds
1	Before	1	1	1	No
	After	3	4	4	Yes
2	Before	1	2	1	No
	After	3	4	4	Yes
3	Before	4	4	3	Yes
	After	4	4	4	Yes
4	Before	2	2	1	No
	After	4	4	4	Yes
5	Before	4	4	2	Yes
	After	4	4	3	Yes
6	Before	3	3	3	Yes
	After	4	4	4	Yes
7	Before	3	5	4	Yes
	After	5	5	5	Yes
8	Before	2	3	4	Yes
	After	4	4	4	Yes
9	Before	2	2	3	No
	After	3	3	4	Yes
10	Before	2	NA	2	No
	After	3	NA	2	Yes
11	Before	3	3	2	Yes
	After	4	4	4	Yes
12	Before	3	3	3	Yes
	After	4	4	4	Yes
13	Before	2	1	1	No
	After	3	4	3	Yes
14	Before	3	2	2	Yes
	After	4	4	4	Yes
15	Before	3	2	3	No
	After	4	4	4	Yes
16	Before	2	2	3	No
	After	4	4	4	Yes

Table 3: Results of paired t-tests for participant subjective assessments pre versus post teaching intervention

Subject of paired t test	Mean improvement	p value	t stat	α value	Power (at $\alpha=0.05$)
Confidence in wound assessment: Pre vs. Post Teaching Intervention	1.25	P<0.0001	7.3193	$\alpha=0.05$	99%
Confidence in suturing: Pre vs. Post Teaching Intervention	1.4	P<0.0001	5.5013	$\alpha=0.05$	99%
Confidence in wound aftercare: Pre vs. Post Teaching Intervention	1.44	P<0.0001	5.9651	$\alpha=0.05$	99%

**Figure 1:** Summary of Pre and Post Intervention Objective and Subjective Ability Scores

independently and undergoing the experience of our teaching intervention.

At four month follow up only 4/16 participants replied to our survey. All four reported they remained competent in independently managing wounds, suggesting sustained improvement in practice. The response was too small however to analyse statistically.

Conclusion

On completion of our project we met our initial aim of producing a novel intervention, introduction on a trust wide level and objectively measuring impact. We would suggest that as this project has demonstrated statistically significant and sustained improvements in objective and subjective abilities of those undertaking Emergency Medicine jobs induction training it may be of benefit to junior doctors also entering surgical training rotations. This could be an area for further study.

Acknowledgment

Ethicon ® Company for provision of suture material and simulation skin for the day of study.

Conflict of Interest

The author declares no conflict of interest.

References

1. Stevenson P, Taggart K, Morgan S. Hospital statistics: emergency care activity 2016/17. Available from: www.health-ni.gov.uk/sites/default/files/publications/health/hs-emergency-care-2016-17.pdf
2. DiMaggio PJ, Waer AL, Desmarais TJ, Sozanski J, Timmerman H, Lopez JA, et al. The use of a lightly preserved cadaver and full thickness pig skin to teach technical skills on the surgery clerkship--a response to the economic pressures facing academic medicine today. *Am J Surg* 2010;

- 200(1):162–6.
3. Steigerwald SN, Park J, Hardy KM, Gillman L, Vergis AS. Establishing the concurrent validity of general and technique-specific skills assessments in surgical education. *Am J Surg* 2016; 211(1):268–73.
 4. Faulkner H, Regehr G, Martin J, Reznick R. Validation of an objective structured assessment of technical skill for surgical residents. *Acad Med* 1996; 71(12):1363–5.
 5. Box JF. Guinness, gosset, fisher, and small samples. *Stat Sci* 1987; 2(1):45–52.
 6. McNemar Q. Note on the sampling error of the difference between correlated proportions or percentages. *Psychometrika* 1947;12(2):153–7.

Appendices

Appendix 1 - Novel Inkert Type Subjective Self- Assessment Form:
 Royal Victoria Hospital Wound Management Induction December 2016
 Please answer the following:

Are you: Postgraduate / Undergraduate

Interested in pursuing surgical training post F2? Y / N

To date how many wounds have you closed independently?
 <5
 5-10
 10-20
 > 20

Please Indicate your confidence (1-5) on wound assessment
 Prior to this session (1) / (2) / (3) / (4) / (5)
 After completing this session (1) / (2) / (3) / (4) / (5)

Please indicate you confidence (1-5) on interrupted suturing
 Prior to this session (1) / (2) / (3) / (4) / (5)
 After completing this session (1) / (2) / (3) / (4) / (5)

Please Indicate your confidence (1-5) on wound aftercare
 Prior to this session (1) / (2) / (3) / (4) / (5)
 After completing this session (1) / (2) / (3) / (4) / (5)

Did you feel you could totally independently manage a wound prior to this session
 Yes
 No

Did you feel equipped to independently manage a wound haven completed this session
 Yes
 No

How satisfied were you with this teaching session
 / (2) / (3) / (4) / (5)