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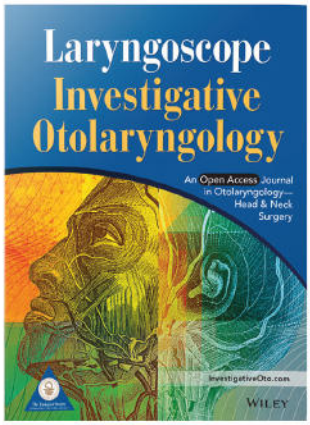

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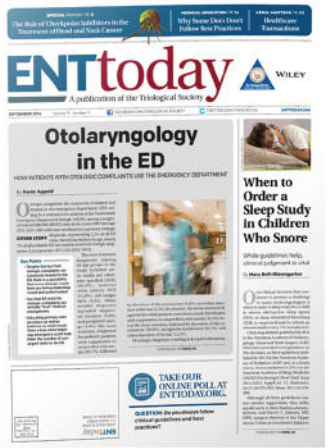

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ORIGINAL RESEARCH

Laryngoscope Investigative Otolaryngology

"No drain, no gain": Validation of novel quinsy simulation model

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Abstract

Objectives:

1. To test a novel, low-cost, home-made model for needle aspiration of PTA.
2. To ascertain whether simulation-based teaching using this model was superior to lecture-based teaching in increasing confidence and reducing anxiety relating to PTA aspiration.
3. To assess whether there was an improvement in outcomes for PTA patients at one hospital following the delivery of a simulation-based training session using our model.

Methods: We designed two teaching sessions for junior doctors starting work in ENT: a simulation-based teaching session using a low-cost home-made simulation model and a lecture-based teaching session covering the same content. We asked the participants to complete pre- and post-session surveys regarding confidence and anxiety levels and analyzed this data. We also retrospectively collected data over 3 months for patients referred to ENT with suspected PTA and assessed their outcomes. We assessed patient outcomes before and after the delivery of a simulation-based training course using our model.

Results: Simulation-based teaching using our model was shown to be associated with a statistically significant increase in junior doctors' confidence levels. Reaccumulation and reattendance rates for PTA following aspiration were 16.67% and 22.7% respectively preintervention and 0% and 7.14% respectively postintervention.

Conclusion: A regular simulation-based teaching session should be introduced using a PTA aspiration model for junior doctors as it leads to increased confidence levels, and reduced reaccumulation and recurrence rates of PTA.

Level of evidence: Level 4.

KEYWORDS

aspiration, peritonsillar abscess, quinsy, simulation

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1 | INTRODUCTION

Peritonsillar abscesses (PTA)/quinsies are the most common deep infection of the head and neck,[1] and contribute a significant component of on-call work in otolaryngology. PTA is defined as the development of an abscess between the tonsil and its capsule. Drainage of the abscess along with antibiotics, symptom control and adequate hydration, is the mainstay of treatment.[2] Without treatment the condition may progress to more extensive deep neck space infections, mediastinitis, septic shock, and death.[1] It is therefore vitally important that doctors on-call for otolaryngology are confident with the management of this condition.

Drainage can take the form of needle aspiration, incision and drainage or, more rarely, tonsillectomy during the acute episode. There is no high-quality evidence concerning the relative effectiveness of these procedures, and correctly identifying which patients would benefit from surgical therapy remains challenging.[3]

In the United Kingdom, the out-of-hours on call doctor for otolaryngology is often relatively junior with minimal or no previous otolaryngology experience. Many of these doctors are covering more than one specialty out of hours. In the majority of cases, the second on call doctor is nonresident. In a survey in 2009, Biswas et al found that 42% of respondents did not feel confident managing common ENT emergencies,[4] including the management of PTA.

Simulation is an increasingly important and valued tool in surgical training.[5-8] Simulation-based training has been shown to aid acquisition of specific clinical skills more effectively than traditional clinical education.[5] A wide range of simulators are already in use in the field of otolaryngology.[6]

Aspiration of a PTA is a new skill for most junior doctors when starting otolaryngology on-calls. Given the challenges in terms of localization of the abscess, the constricted work space within the oropharynx, the proximity of the internal carotid artery and patient discomfort, this procedure can cause anxiety. Simulation is ideal for learning this skill as it allows trainees to improve their skills and confidence in a safe and undaunting environment.[7]

We have developed a simple, user-friendly, cost-effective simulation model for teaching needle aspiration of PTA. The purposes of this article are to demonstrate that this model leads to reduced anxiety levels and increased confidence levels in junior doctors.

2 | METHODS

The simulation-based and lecture-based teaching programs were delivered at St Mary's Hospital, London, and The Royal London Hospital. They were both delivered as induction courses for junior doctors at the outset of their otolaryngology rotations. The aim of the courses was to provide a brief introduction to the management of common otolaryngology emergencies. The audit regarding patient outcomes was performed at the Royal London Hospital. No patients were involved in this study and therefore patient consent was not required. No personal data, patient information or professional information was taken from participants therefore ethical approval was also not formally sought for this project, but departmental approval was granted for the project to be undertaken.

2.1 | The model

The simulation-based training at St Mary's Hospital included teaching on PTA aspiration using our home-made simulation model. Below is a picture of the model with explanations of how to use it (Figures 1 and 2).

2.2 | Participants

There were 14 participants in the simulation-based training session. Of these 14 candidates, three were international medical students, nine were in the second year of the foundation program (the 2-year, general postgraduate training program between medical school and specialist or general practice training in the United Kingdom), three were in the first year of the foundation program, and two had completed the foundation program. Participants were recruited on a

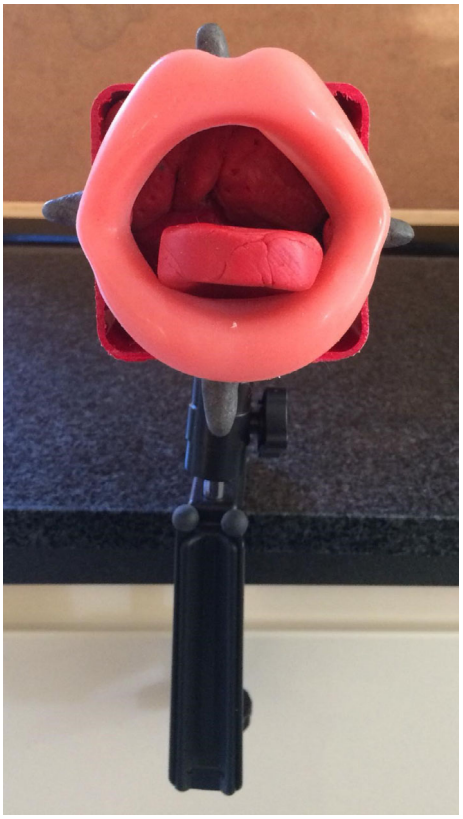

FIGURE 1 Home-made quinsy model (anterior view). Users are able to simulate how they would drain the quinsy using this model by being able to retract the tongue and wear a headlight as they would for a real patient. The model can be secured with a plastic screw to a table top, and the part of the model with a quinsy can also be adjusted at different angles if required



FIGURE 2 A prefilled balloon is placed posteriorly into the model and secured with a cork. The balloon can be filled with any material to simulate pus—we used color gel soap. Delegates can then practice the one-handed aspiration technique of draining a quinsy using the model. A different balloon should be used each time a participant practices on the model

voluntary basis. The session was advertised through email and verbal correspondence, and participants were able to sign up on a first come first serve basis. All those participating were asked to provide information regarding their previous experience of ENT in an undergraduate and postgraduate setting by number of weeks spent during the rotation. Out of 14 participants, the average number of weeks spent in ENT in an undergraduate setting was 1 week, and none of the participants had any experience of ENT in a postgraduate setting.

There were 13 participants in the lecture-based training session, and they were all in the second year of the foundation program. This session also covered management of common otolaryngology emergencies, but the content was delivered via lectures rather than using simulation. The session was advertised through email and verbal correspondence, and participants were able to sign up on a first come first serve basis. All those participating were asked to provide information regarding their previous experience of ENT in an undergraduate and postgraduate setting by number of weeks spent during the rotation. Out of 13 participants, the average number of weeks spent in ENT in an undergraduate setting was 1.5 weeks, and none of the participants had any experience of ENT in a postgraduate setting.

2.3 | Data collection

Candidates were asked to complete anonymous pre- and post-teaching session surveys developed by our team. These surveys used a 10-point Likert scale to assess confidence levels relating to needle aspiration of PTA. The same pre- and post-teaching session surveys were used for both the simulation-based and lecture-based teaching sessions. They were completed on the day, immediately prior to and after the teaching session. A score of 10 indicated extremely confident and a score of 0 indicated no confidence. The surveys were completed on the day, immediately prior to and after the teaching sessions.

2.4 | Patient outcomes audit

At the Royal London Hospital, we collected data on 50 patients over a 12-week time period from 6 weeks prior to the simulation-based teaching and 6 weeks afterwards (24/08/18 to the 16/11/18). The patients chosen were those who had been seen by the junior doctors attending the simulation-based teaching. The same doctors worked in the department pre- and post-intervention.

Patients were identified using the ENT team handover document on our specialist ENT drive. Data were collected from Powerchart (Millennium Health) electronic patient record. Only patients that warranted ENT referral were included, therefore patients with uncomplicated tonsillitis/upper respiratory tract infection that were discharged by the Emergency Department doctors were not included. To ensure patients were not missed by being directly discharged without being on the handover list, junior doctors were encouraged to add all patients to the handover list (even if discharged) for this period of time.

Patients included were those where the diagnosis was of PTA/peritonsillitis (PT)/tonsillitis. PTA was defined by the presence of pus on aspiration, where a dry tap with unilateral symptoms was here taken as PT. Tonsillitis was defined by the classical findings of bilaterally inflamed tonsils with no drainable collection.

For patients who had multiple attendances/admissions within the time period, the first attendance was taken as the date of presentation. All subsequent attendances pertaining to acute tonsillar pathology (outside of planned follow-up) were regarded as a reattendance. Reaccumulation was defined as a drainable collection of pus present on subsequent reattendance.

Microsoft Excel (Microsoft, Redmond, Washington) was used to create a database. Patient demographics were assessed along with reattendance and time to reattendance. Data were presented as median and interquartile ranges. Primary end-points were: (1) incidence of reaccumulation requiring further intervention pre- and post-simulation-based teaching and (2) incidence of PTA reaccumulation pre- and post-simulation-based teaching. Secondary end-points were: (1) total number of aspirations pre- and post-simulation-based teaching and (2) further imaging required and pre- and post-simulation-based teaching.

3 | RESULTS

3.1 | Simulation-based teaching

The average confidence levels for needle aspiration of PTA before the simulation-based training session was 3.7.

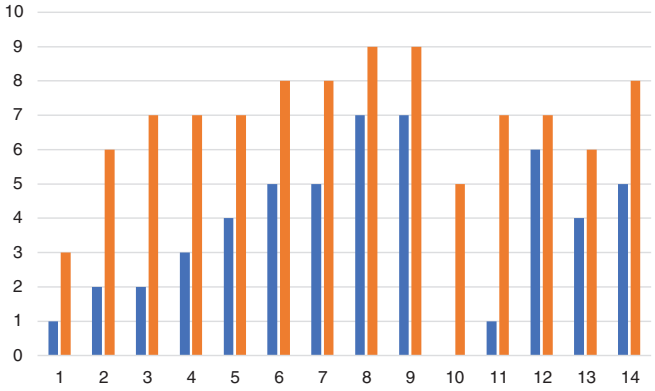

FIGURE 3 confidence levels for aspiration of quinsy before and after simulation-based induction. This was measured using a 10 point Likert scale. A score of 10 indicated extremely confident and a score of 0 indicated no confidence regarding the procedure. The surveys were completed on the day, immediately prior to and after the teaching sessions

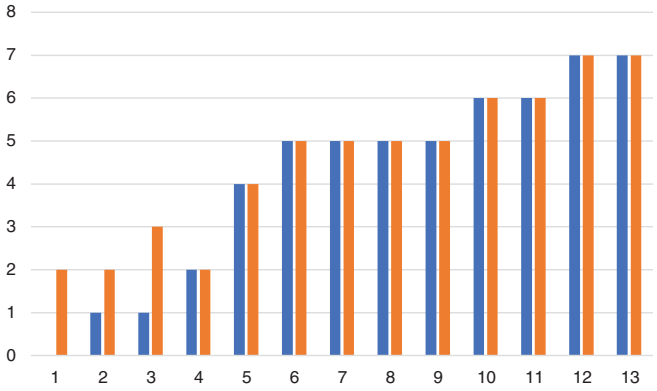

FIGURE 4 Confidence levels for each candidate for aspiration of quinsy before and after lecture-based induction. This was measured using a 10 point Likert scale. A score of 10 indicated extremely confident and a score of 0 indicated no confidence regarding the procedure. The surveys were completed on the day, immediately prior to and after the teaching sessions

After the simulation-based training session, the average confidence levels for PTA aspiration increased to 6.9.

The unpaired *t* test was used for statistical analysis. This showed a statistically significant increase in confidence levels for needle aspiration of PTA after the simulation-based training session (Figure 3).

3.2 | Lecture-based teaching

The average confidence levels for needle aspiration of PTA before the lecture-based training session was 4.15.

After the lecture-based training session, the average confidence levels for all the candidates for quinsy aspiration increased to 4.5.

The unpaired *t* test was used for statistical analysis. This did not show a statistically significant increase in confidence levels for needle aspiration of PTA after the lecture-based teaching session (Figure 4).

3.3 | Comparison pre- and post-simulation-based teaching

3.3.1 | Patient characteristics

A total of 50 patients with PTA/peritonsillitis(PT)/tonsillitis were identified over 12 weeks, an average of four cases per week.

The median age was 26 (IQR 22-34) with a range of 12-61. 32 (64%) of the patients were male and 18 (36%) of the patients were female.

Twenty-seven (54%) of referrals came from the emergency department and 11 (22%) from GPs with 12 (24%) referrals from other hospitals. Eighty-eight percent of patients were referred as a PTA, 10% as tonsillitis and 2% as stridor.

The median duration of symptoms was 4 days, while the most commonly reported symptoms were sore throat (present in 98%), difficulty swallowing (78%), fevers (52%), and voice change (34%) (Table 1).

3.3.2 | Diagnosis

Eighty percent of patients had unilateral findings on clinical examination, while cervical lymphadenopathy was present in 64%. Forty percent of patients underwent nasendoscopy at some point during admission. Twelve percent in underwent CT neck to further evaluate pathology. This was done if there was diagnostic uncertainty. Post ENT review 29 (58%) of patients were a confirmed PTA. This is a 30% difference between the referral diagnosis (95% CI 12.71-45.17, $P = .0008$).

3.3.3 | Management and patient outcomes

One hundred percent (50 patients) of patients received antibiotics while 76% (38 patients) received dexamethasone. Needle aspiration was attempted on 78% (39 patients) while only 4% (two patients) underwent incision and drainage. There were no hot tonsillectomies performed during the data collection period. The average length of stay was 1.21 days, with a minimum stay of half a day and a maximum of 6 days.

3.3.4 | Comparison pre- and post-simulation-based teaching

Our intervention was the simulation-based training for needle aspiration of PTAs. Having already established that simulation-based training is more effective than lecture-based training at increasing confidence and reducing anxiety in this skill, we decided to examine

TABLE 1 Comparison of outcomes for patients pre- and post-simulation-based teaching

Comparison pre- and post-SBT					
	Preintervention	**Postintervention**	**Relative risk (RR)**	**95% CI**	***P* value**
N	22	28	–	–	–
CT neck	4 (18.18%)	3 (10.71%)	0.59	0.15-2.36	0.46
Dry tap	9 (50%)	9 (39.13%)	0.79	0.38-1.64	0.52
Average aspiration attempts	1.27	1.43	–	–	–
Reaccumulation	3 (16.67%)	0 (0%)	0.11	0.01–2.08	0.14
Reattendance	5 (22.72%)	2 (7.14%)	0.31	0.07-1.47	0.14
Pus aspirated on reattendance	5 (100%)	0 (100%)	–	–	–
Average length of stay (days)	1.29	1.17	–	–	–

Notes: The patients selected were those who were treated by the junior doctors who took part in simulation-based teaching to allow for comparison.

the effects of simulation-based training on patient outcomes. Our control group was the group of patients treated preintervention (ie, no junior doctor training at all), which included 22 patients. The postintervention group (ie, postsimulation-based training) included 28 patients.

Reaccumulation was evident clinically in 16.67% of patients (three patients) preintervention and in no patients postintervention with a relative risk of 0.11 (95% CI 0.01-2.08, $P = .14$). Reattendance was seen in 22.72% (five patients) preintervention and 7.14% (two patients) postintervention.

CT neck was performed on 18.18% (four patients) of the preintervention group and 10.71% (three patients) postintervention with a relative risk (RR) of 0.59 (95% CI 0.15-2.36, $P = .46$). A dry tap was seen in 50% (nine patients) preintervention and 39.13% postintervention (RR 0.79, 95 CI 0.38-1.64, $P = .52$). The average aspiration attempts were higher in the group postintervention (1.43 vs 1.27) (Table 1).

4 | DISCUSSION

Simulation is a vital component of medical education, and will undoubtedly grow in importance in the future as more innovative simulation models are developed.[6,8] Simulation holds a particularly important role in surgical education as it facilitates the acquisition of manual skills in a safe environment. The skills can be practiced repeatedly with deliberate focus on particular aspects, ensuring that the trainee becomes confident with the equipment and the techniques involved. Simulation-based medical education with deliberate practice has been shown to be superior to traditional clinical education for a wide range of medical skills, from laparoscopic surgery to advanced cardiac life support.[4] There is now a growing body of evidence that shows that clinical skills taught and practiced using simulation transfer directly to improved clinical care and better patient outcomes.[9-13]

We believe that simulation-based training holds particular value in teaching needle aspiration of peritonsillar abscesses. The reasons for this are multifold. First, during the procedure patients are conscious, in pain and distressed; confidence and composure in the medical practitioner performing the aspiration can go a long way to making this a less wretched experience for both patient and doctor. Second, the doctors performing this procedure on call are often junior and lacking in experience.[4] Third, the procedure requires a combination of skills that are often unfamiliar to the fledgling otolaryngologist—use of a headlamp, proper positioning, identification of the anatomy of the oropharynx, adequate analgesia, bimanual dexterity, and in particular single-handed aspiration of the abscess. Various simulation models have been developed for procedures within otolaryngology,[7] including some peritonsillar abscess models.[14-16] However, our model is the first to our knowledge that has been validated in this way and is easily reproducible.

We constructed a low-cost simulation model of a peritonsillar abscess using readily available materials. The cost of the model is less than £10 including raw materials. The model is made using a camera stand used to house the oropharynx and oral cavity, which is easily available with plastic inserts and rubber used to create the mouth, tongue and tonsils. A space was created in the peritonsillar place to allow a filled balloon to be placed there, secured by a cork. This is the area that represents the quinsy and that delegates are meant to aspirate. The availability and cost will make it easy for other institutions to incorporate use of this model into their training programs. The model can be quickly and easily set up, allowing for repeated practice (using separate prefilled balloons). We assessed the validity of the model for junior otolaryngology doctors, the group most likely to use and benefit from this model in the future. These doctors came from a range of different backgrounds, but most had very limited practical otolaryngology experience. Our model has been statistically proven to reduce anxiety levels and increase confidence levels amongst junior doctors. It is ideal for an induction as it allows focused training on a particular useful new skill and in a short amount of time multiple trainees can have the opportunity to increase their confidence significantly (Figures 2 and 3).

CT scans were performed if there was diagnostic uncertainty or if symptoms remained to ensure that the quinsy was adequately drained. Our results showed that less CT scans were ordered after

training had occurred which implies that the training itself had a direct impact on the technique used and adequate drainage of the quinsy. This is also confirmed with the reduction of patients having a dry tap after training as it implies that the reason they did have a dry tap could be due to poor technique. The number of attempts of aspiration in the post-training group was higher; this may represent increased confidence and familiarity of the doctors after training. Our patient outcomes audit showed that, within the limitations of our small sample size, PTA reaccumulation rates and recurrence rates were lower following a simulation-based training session for junior doctors than they were without any training.

4.1 | Limitations

Despite the aforementioned advantages of our peritonsillar abscess model there are some limitations we must acknowledge. First, our model is designed to train users in needle aspiration of a peritonsillar abscess, and cannot be used to teach incision and drainage. However, from a literature search, we note that there is no established body of evidence supporting incision and drainage over aspiration. It is therefore appropriate in the first instance to make sure that junior doctors on-call are comfortable with needle aspiration. Continued research is required to assess how skills learnt in simulation settings translate into real world practice.

Second, we acknowledge that the size of the sample of junior doctors involved in the teaching sessions was small, and statistical significance was not achieved for certain results such as reduction in number of CT scans ordered. The number we achieved was in keeping with the relatively small number of junior doctors in our local training region (North West London) who do otolaryngology rotations. To more robustly validate our model, we could broaden our recruitment to include junior doctors in other specialties (eg, A + E) or offer teaching sessions in other regions.

Third, the sample size of our patient outcomes audit was small. Including multiple centers in future research would enable more robust evaluation of the effect of simulation-based training on patient outcomes. We must also acknowledge the fact that we have not controlled for other factors that may contribute to improved skill in needle aspiration of PTAs. In particular, it is possible that over the 12-week period examined there was an improvement in PTA aspiration technique due to learning "on the job" or other learning (eg, observing seniors, reading textbooks, video resources).

Fourth, we examined patient outcomes before and after a simulation-based training session was delivered. This does not compare lecture-based training with simulation-based training and therefore we cannot draw conclusions as to how patient outcomes might be affected by these two different interventions.

5 | CONCLUSIONS

- Training using our home-made PTA simulation model increases confidence and reduces anxiety related to the procedure in junior doctors starting an otolaryngology job.
- This model may therefore be useful in induction/introductory courses for junior doctors new to otolaryngology.
- Our model is a low cost and easy to reproduce so it can be used by other institutions.
- There was a reduction in reaccumulation rates and recurrence of PTA in one hospital after delivery of a simulation-based training session using our model.

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CONFLICT OF INTEREST

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. We have no conflicts of interest to report.

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