



Measurement of Intraocular Pressure in the Emergency Department – An Educational Quality Improvement Project

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Abstract:

Background: Primary care physicians are facing both increasing volume and complexity of ocular presentations. The tonometer, a device used to measure intraocular pressure, is a useful component of the eye examination which can aid in the differentiation of serious ocular pathologies.

Objectives: Primary aim was to achieve 100% of the ED care providers being trained on how to use the department's tonometer. Secondary aims were to subjectively improve ED staff's successful tonometer set up and the interpretation of the IOP readings.

Methods: This educational quality improvement project shares how an Emergency Department District General Hospital has trained its physicians to both correctly utilise the tonometer and interpret its results.

Results: Three cycles of improvements have shown a significant improvement in successful tonometer set up and interpretation within a high percentage of working physicians.

Conclusions: This project has contributed to more thorough general eye assessments; supported decisions to allow safe discharge; and developed more comprehensive referrals. This educational report reflects a simple and replicable strategy to improve primary eye care triage and services.

Background:

The Royal College of Ophthalmologists released 'Emergency Eye Care' guidance in 2020 which identifies that increasing numbers of patients are presenting to the Emergency Department (ED) with eye presentations [1]. The report acknowledges the challenge that the ED has in identifying true life or sight threatening emergencies in an environment which is not always designed to deal with these presentations. The guidance furthermore recognises that often the lack of both specialist equipment and appropriately trained initial assessors are significant barriers in providing an effective and cost-effective eye service overall.

The tonometer is a piece of equipment that has become increasingly present in the toolbox of the emergency physician and is designed to measure the intraocular pressure (IOP) of the eye. As with other units of pressure, IOP is measured in millimetres of mercury (mmHg). Various forms of tonometers exist, however typically in the ED setting handheld devices that utilise non-contact principles to estimate IOP are more common. In the absence of other specialist pieces of ophthalmological equipment, an IOP measurement can be vital in differentiating sight threatening emergency ocular pathology quickly. In addition, better IOP assessments allow more thorough general eye assessments; support decisions to allow safe discharge; and develop more comprehensive referrals. Despite the value of IOP measurements in an emergency setting, both knowledge and interpretation of the values can be lacking when physicians are not trained on the use of the tonometer nor on interpretation of its' values.

A literature search was undertaken analysing published data on the use of the tonometer in the ED setting. One study analysing ED referrals to Ophthalmology centres found that 75% of referrals did not measure IOP at all, and those that did varied from ophthalmologists' readings by an average of 4.30 +/- 4.39 mmHg [2]. There are case reports citing the clinical value of tonometer use in the ED [3, 4], however no published data exists which quantifies and explores tonometer use in the ED.

The primary aim of this project was to achieve 100% of the ED care providers being trained on how to use the department's tonometer. Secondary aims were to subjectively improve ED staff's successful tonometer set up and the interpretation of the IOP readings.

Methods

This project was undertaken at a small district general hospital. An audit was undertaken to establish the barriers emergency department care providers face in taking and interpreting IOP. A cohort of care providers were assessed on their ability to successfully set up an iCare tonometer. Subsequently,

the care providers completed an anonymous survey exploring the difficulties of the tonometer use. This survey incorporated a 10-point Likert scale (1 being least confident) to analyse confidence in tonometer set up and IOP interpretation as well as space for qualitative feedback. Successful set up was considered when the physician correctly prepared and executed an IOP reading. Correct IOP interpretation was when the physician identified if a produced reading was 'very high' (>40mmHg), 'high' (18.2 - 40mmHg), 'normal' (9.0-18.1mmHg), 'low' (6.5-8.9mmHg) or 'very low' (<6.5mmHg).

The tonometer is a delicate and sensitive piece of equipment to use and, particularly under challenging circumstances, clinicians can easily struggle to use a piece of equipment which they use so rarely. Therefore, a simple standard operating procedure was created and delivered through group education sessions followed by further sampling of physician understanding. This was further consolidated through the creation of an intraocular pressure interpretation tool (Figure 1) which guides clinicians in recognising both abnormal values and associated pathology [3-5]. For the second round of intervention, individual education sessions were undertaken.

Results

Total physicians working in ED who are expected to examine eyes at time of sampling = 30.

Total individually sampled physicians = 28

Table 1: Pre intervention, n=12

Primary outcome		Secondary outcomes		
Trained on tonometer		Successful set up on first attempt	IOP interpretation confidence (average score)	Overall confidence in tonometer use (average score)
Yes 33%	No 67%	26%	4.3/10	3.2/10

Table 2: First intervention – Group teaching and SOP, n=8

Primary outcome		Secondary outcomes		
Trained on tonometer		Successful set up on first attempt	IOP interpretation confidence (average score)	Overall confidence in tonometer use (average score)
Yes 62%	No 38%	59%	6.0/10	5.9/10

Table 3: Second intervention – individual education, n=8

Primary outcome		Secondary outcomes		
Trained on tonometer		Successful set up on first attempt	IOP interpretation confidence (average score)	Overall confidence in tonometer use (average score)
Yes 100%	No 0%	89%	9.1/10	8.9/10

Conclusion

Access to face to face specialist ophthalmology review has been moved off site from this District General Hospital. Furthermore, over the Covid-19 pandemic complex patients previously cared for by outpatient clinics and community services are presenting more frequently to ED's. The expectation and extent of detail in terms of examination has evolved rapidly over time and the introduction of new technology to support thorough assessment, safe discharge or effective referral is one aspect of this changing landscape of care. Following a comprehensive quality improvement project the awareness of intraocular pressure measurement has developed in our district general team. This quality improvement project reflects an easily reproducible and novel approach in improving eye assessments in the ED setting.

The primary outcome was to achieve 100% of ED physicians being trained on the tonometer use which was met. The secondary outcomes of improving ED physician successful tonometer set up, confidence in the tonometer use and the interpretation of the IOP readings also succeeded; achieving more than a two-fold subjective increase in each of these areas. This project did not directly analyse changes in patient care, however by improving ED physician awareness of this aspect of eye care, hopefully emergency ocular presentations will be managed better by these physicians in the future because of it.

When completing a clinical quality improvement project, the ultimate hope is that patient care improves because of your interventions. The next stage of this audit cycle to retrospectively assess the impact of these interventions on ophthalmology referral quality from the ED. Both the volume of eye referrals to secondary ophthalmology review and the referral detail including measurement of intraocular pressure will be compared in the year before and after this project.

References

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