

# Emergency canthotomy and cantholysis - Factors affecting confidence among ophthalmic trainees in the United Kingdom

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**Purpose:** Retrobulbar hemorrhage from trauma is the most common cause of orbital compartment syndrome. Emergency canthotomy and cantholysis is a vision-saving procedure. We sought to identify confidence among ophthalmic trainees in this procedure as well as any relevant factors that have any impact. **Methods:** An online, confidential anonymous questionnaire was distributed to ophthalmology training groups in the UK. Questions explored the participant's stage of training and grade and confidence in this area as well as their ophthalmic experience in terms of training courses attended and elective versions of the procedure performed. **Results:** We received 45 completed responses from the survey. 20/23 (87%) of junior trainees had not performed an emergency canthotomy/cantholysis to date, whereas 19/22 (86%) of senior trainees had performed between 1 and 5 such procedures. 15/23 (65%) of junior trainees had not performed an elective canthotomy compared to only 3/22 (14%) of the senior trainees. We found that the main factors that were associated with increased confidence level were the higher numbers of emergency and elective cases performed, training courses, and previous oculoplastic surgery rotation ( $P = 0.0001$ ). **Conclusion:** From our survey, we found low confidence levels among junior trainees due to limited exposure. Confidence appeared to be linked to both elective and emergency surgical experience of the procedure as well as training course and having worked in an oculoplastic surgery firm. Changes to training portfolio requirements for junior trainees to incorporate early oculoplastic experience may help to achieve this on a national scale.

**Key words:** Lateral canthotomy and cantholysis, ophthalmology training, retrobulbar hemorrhage, orbital compartment syndrome

Retrobulbar hemorrhage from trauma is the most common cause of orbital compartment syndrome.<sup>[1]</sup> Other causes of retrobulbar hemorrhage include iatrogenic causes such as eyelid, orbital and lacrimal surgical procedures, peribulbar or retrobulbar injections, and nonophthalmic procedures (e.g., sinus, craniofacial, and neurosurgery). It is an ophthalmic emergency and immediate intervention in the form of lateral canthotomy and cantholysis is required to save vision. Ophthalmologists in the United Kingdom (UK) are required to be competent in the procedure, especially trainees of all grades who provide emergency services out of hours. Although lateral canthotomy and cantholysis is a part of common elective oculoplastic surgery and part of the curriculum set by the Royal College of Ophthalmologists, junior ophthalmologists may not be familiar with the procedure that makes it more difficult to perform in an emergency setting. Furthermore, the incidence of retrobulbar hemorrhage is low<sup>[2]</sup> and this makes it difficult to achieve repeated exposure in practice. Therefore, we have conducted a survey to identify the confidence level in performing lateral canthotomy and cantholysis in ophthalmic trainees in the UK and any factors that may have impact.

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## Methods

We have performed an online survey, which was distributed to ophthalmologists in training in the UK via the regional representatives of the ophthalmologists in the Training Group of the Royal College of Ophthalmologists, emails of established networks, and social media. This excludes consultants. The survey was designed to canvas their confidence level in performing the canthotomy and cantholysis and any other factors that may have impact. We focused our work on retrobulbar hemorrhage secondary to trauma as the most common cause. The survey was open from June 22, 2020 to July 26, 2020. We collected data on the stage of training, number of cases performed in emergency, and elective settings. We also asked whether the participants have had a rotation in oculoplastic surgery or attended any relevant courses. Finally, we have assessed the confidence level on performing lateral canthotomy and cantholysis in an emergency setting.

We have prepared the survey data for analysis through data cleaning and feature engineering. This involved reviewing the

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responses individually to remove duplicate data, formatting the data to ensure consistency, and consolidating the variables to create large sample groups.

The Shapiro–Wilk test found data to be non-normally distributed; therefore, we performed the Wilcoxon test and one-way ANOVA to assess the impact of various factors on confidence level. Analyses were performed using R: A Language and Environment for Statistical Computing (R Core Team). Statistical significance was described in *P* value.

## Results

### Demographics

In the latest Workforce Census published by the Royal College of Ophthalmologists in 2018, there are 706 ophthalmologists in training in the UK.<sup>[3]</sup> We received a total of 45 responses, which comprises 6.4% of ophthalmic trainees. In the UK, the ophthalmology program is a 7-year specialty training from ST1 (Year 1) to ST7 (Year 7) approved by the General Medical Council. Junior trainees are considered to be ST1–3 and senior trainees ST4–7 [Table 1].

### Number of cases performed in an emergency setting

We asked how many cases of lateral canthotomy and cantholysis they have performed in an emergency setting [Table 2]. As expected, junior trainees had the least experience in the canthotomy and cantholysis in an emergency setting. For example, none of ST1 trainees had experience. Only 25% and 12% of ST2 and ST3 trainees had 1–5 cases performed,

respectively. As trainees become more senior, the majority have the experience of performing the procedure, 100% in ST6 and seven trainees.

### Number of cases performed in an elective setting

It showed that the trainees had more experience of performing lateral canthotomy and cantholysis in an elective setting [Table 3]. It appears that the junior trainees have more experience in elective surgery compared to emergency cases; however, the percentages of no experience still ranged from 50% to 86%. As expected, the number of elective cases goes up as the trainee became more senior. It showed that the majority of ST4 (88%) and ST5 (75%) trainees had elective experience. For ST6 or ST7 trainees, all of them had performed elective canthotomy and cantholysis.

### Does an oculoplastic surgery rotation help with confidence level?

We asked whether they have had their oculoplastic surgery rotation so far in their training [Table 1]. Oculoplastic surgery experience is mandatory as part of the College curriculum before the completion of training program. We observed that as the trainees become more senior, they are more likely to have had the rotation. For example, only 38%–57% of junior trainees have had the placement compared to 75%–100% in senior trainees.

### Attendance of any training course

We asked whether they attended any relevant training sessions—22 answered yes and 23 answered no. The mean confidence level of those who attended training courses was 3.5 compared to 2.6 in the those who did not attend.

### Factors that had an impact on the confidence level in performing lateral canthotomy and cantholysis

We asked how confident ophthalmologists felt in performing lateral canthotomy and cantholysis in an emergency setting [Table 1]. This was assessed using a 5-point Likert scale anchored at “1 = not confident” and “5 = very confident.” We found that the mean and median of the confidence score for junior trainees were 1.6–2.5 and 1–2, respectively. For senior trainees, they were higher; in particular, they were 4.8–5 and 5, respectively, for ST6 and ST7 trainees.

We identified five factors that had impact on confidence level: the number of emergency and elective surgery cases, oculoplastic

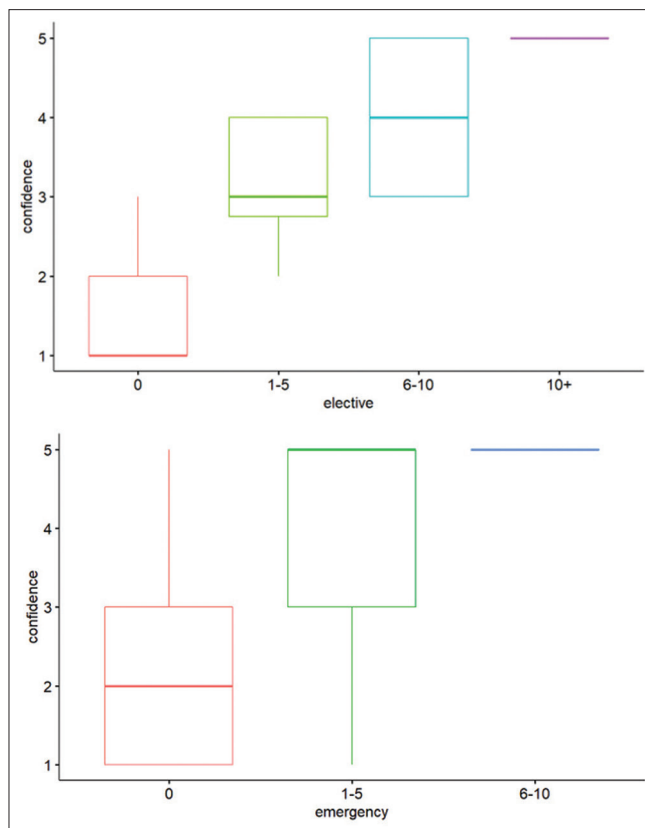


Figure 1: Box plot of emergency and elective surgery

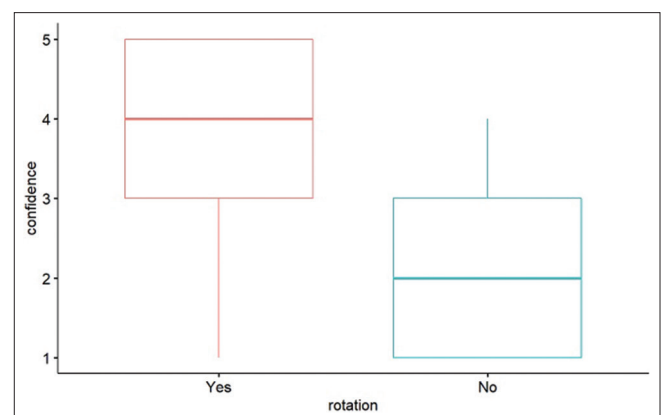


Figure 2: Box plot of oculoplastic rotation

**Table 1: The number of responses in each grade/position (percentages in brackets)**

Grade/Position	Number of responses	Oculoplastic surgery rotation		Confidence level	
		Yes	No	Mean	Median
ST1	7 (15.6%)	4 (57%)	3 (43%)	1.6	1
ST2	8 (17.8%)	4 (50%)	4 (50%)	2.5	2
ST3	8 (17.8%)	3 (38%)	5 (62%)	2.1	1
ST4	8 (17.8%)	6 (75%)	2 (25%)	3.8	3.5
ST5	8 (17.8%)	5 (62%)	3 (38%)	3.9	3.5
ST6	4 (8.9%)	4 (100%)	0	4.8	5
ST7	2 (4.3%)	2 (100%)	0	5	5
Total	45 (100%)	28 (62%)	17 (38%)		

**Table 2: Number of cases performed in an emergency setting (percentages in brackets per grade)**

		None	1-5	5-10	10+	Total
Junior trainee	ST1	7 (100%)	0	0	0	23
	ST2	6 (75%)	2 (25%)	0	0	
	ST3	7 (88%)	1 (12%)	0	0	
Senior trainee	ST4	0	7 (88%)	1 (12%)	0	22
	ST5	3 (38%)	5 (62%)	0	0	
	ST6	0	4 (100%)	0	0	
	ST7	0	2 (100%)	0	0	
Total						45

**Table 3: Number of cases performed in an elective setting (percentages in brackets per grade)**

		None	1-5	5-10	10+	Total
Junior trainee	ST1	6 (86%)	0	1 (14%)	0	23
	ST2	4 (50%)	3 (38%)	1 (12%)	0	
	ST3	5 (63%)	1 (12%)	2 (25%)	0	
Senior trainee	ST4	1 (12%)	1 (12%)	5 (64%)	1 (12%)	22
	ST5	2 (25%)	2 (25%)	2 (25%)	2 (25%)	
	ST6	0	1 (25%)	0	3 (75%)	
	ST7	0	0	0	2 (100%)	
Total						45

rotation, training grade, and attendance of a training course. With regard to emergency surgery, we have found that the difference of confidence level between 0 and 1–5 ( $P = 4.6 \times 10^{-6}$ ) and 0 and 6–10 emergency cases ( $P = 0.047$ ) were statistically significant [Fig. 1]. When the two groups of 1–5 and 6–10 emergency cases were compared, no statistically significant difference was observed ( $P = 0.70$ ). Therefore, it appears that if one has performed an emergency surgery more than once, it is associated with an increased confidence level. A similar trend was observed in elective surgery experience. We found that there were statistically significant differences when comparing groups between 0 and 1–5 ( $P = 2.7 \times 10^{-4}$ ), 0 and 6–10 ( $P = 4.3 \times 10^{-9}$ ), 0 and 10+ ( $P = 5.9 \times 10^{-12}$ ) and 1–5 and 10+ ( $P = 1.3 \times 10^{-4}$ ) and 6–10 and more than 10 cases ( $P = 0.042$ ) [Fig. 1]. It appears that the higher confidence level is associated with the higher number of elective cases performed. We also found that the mean confidence level of those who have not had a rotation

in oculoplastic surgery is less than those who have had a rotation (2.0 vs. 3.7) [Fig. 2]. This difference was statistically significant ( $P = 0.0001$ ). When comparing the mean confidence levels of different grades, it was 2.1 for junior trainees, compared to 4.1 in the senior trainee group. This difference was also statistically significant ( $P = 7.05 \times 10^{-7}$ ). There was a statistically significant difference between the confidence levels of trainees between those who have attended a training course and those who have not (2.6 vs. 3.5,  $P = 0.017$ ).

## Discussion

Orbital compartment syndrome is an ophthalmic emergency. The most common cause is the retrobulbar hemorrhage from trauma but it can also occur from iatrogenic causes such as orbital, eyelid, lacrimal and sinus surgeries, and peribulbar or retrobulbar injections.<sup>[1]</sup> It is thought that the expansion of orbital volume by the hemorrhage exerts pressure on the optic nerve in a confined orbital space hence causing ischemia. Once diagnosed, it requires an immediate intervention to decompress the orbit and the most commonly employed technique is the lateral canthotomy and cantholysis. It is considered to be best performed within 2 h of injury.<sup>[4]</sup> Yung *et al.* found that canthotomy produced a mean intraocular pressure reduction of 14.2 mm Hg and cantholysis 30.4 mm Hg.<sup>[5]</sup> In the UK, ophthalmic trainees of all grades provide emergency ophthalmic service out of hours; therefore, they are expected to perform emergency canthotomy and cantholysis when clinically indicated with senior support available if required.

We found a few studies relating to the confidence in the diagnosis of orbital compartment syndrome and in performing emergency canthotomy and cantholysis. A survey published in 1996 showed that 83% of senior house officers were unable to make the correct diagnosis and initiate appropriate referral or treatment.<sup>[6]</sup> With regards to performing emergency canthotomy and cantholysis, it was found that 78.7% would initially undertake CT imaging first even though the clinical suspicion was strong. Only 37.1% responded that they would perform the procedure themselves. The main reason was lack of training (91.4%). A more recent survey was reported in 2019 in the emergency department physicians of all training grades in the UK to study their experience in the diagnosis of orbital compartment syndrome and performing lateral canthotomy and cantholysis.<sup>[7]</sup> It showed that the Emergency Department doctors were confident in diagnosing retrobulbar hemorrhage—82.8% correctly diagnosed it and 95.7% recognized that it led to an irreversible loss of vision. This

indicates a significant improvement in diagnostic skills over the years in the UK. In the United States, a prospective study was performed to assess the impact of training on ophthalmology residents in their confidence performing lateral canthotomy and cantholysis.<sup>[8]</sup> Following human cadaveric training, residents reported an increase in knowledge and comfort in performing the procedure.

Thus far, there is no study assessing the confidence level of ophthalmic trainees in performing emergency canthotomy and cantholysis in the UK. Our study found that ophthalmologists in training in the UK were generally confident in performing emergency canthotomy and cantholysis except the junior trainees, who were less confident in both emergency and elective settings. The confidence level increased as the trainee became more senior and this appears to be due to the increased experience and exposure of the procedure in emergency and elective surgery. This confirms what we already know intuitively and we believe this is important. Not only does it provide objective evidence to anecdotal experience, but also provides some guidance to potential changes in curriculum in the future. Current requirements in the UK Ophthalmic Specialty Training program require two canthotomy and cantholysis procedures to be performed by the final year of training (ST7).<sup>[9]</sup> We hope that this is at least maintained, or certainly better represented in the curriculum, not diminished in the event of the program review and change in the future. The incidence of ocular compartment syndrome requiring emergency procedure is low therefore such training opportunities cannot be planned or guaranteed. Despite that, our results showed that senior trainees do achieve the competence level required which is reassuring. It suggests that there is certainly a need for further training to support junior trainees who form part of emergency ophthalmic service out of hours. Our study suggests elective surgery experience and oculoplastic rotation increase confidence level in performing canthotomy and cantholysis. Given that orbital compartment syndrome is associated with significant morbidity, it suggests the need for a change in the curriculum, potentially introducing oculoplastic rotation early in the specialist training. However, we appreciate that this may not be feasible in all hospitals. Instead, it may be worth considering a change in the curriculum so that the canthotomy and cantholysis as a mandatory competency is introduced at a junior level such as ST1-2 to formally support the training. On this note, our results showed that attendance of relevant training courses was associated with greater surgical confidence, however, we have not differentiated between different types of training courses such as lecture-based or cadaver-based ones in this study. It would be useful to perform another survey with different types of courses and see which one is most helpful. We postulate that cadaver dissection courses are likely to increase confidence level. It closely simulates elective surgical experience and it has been shown to be effective in ophthalmology residents in the US.<sup>[8]</sup> Following this, it may be beneficial to incorporate other topics covering conditions associated with high morbidity and mortality such as endophthalmitis (vitreoretinal) and surgical third nerve palsy (neuro-ophthalmology) in the early years of specialist training.

One limitation of our study is that the number of responses could be improved. The survey was distributed through several means including the regional representatives of the Ophthalmologists in the Training Group of the Royal College of Ophthalmologists. There are a couple of reasons why the

response rate was low. Firstly, the survey was not mandatory compared to some others, for example, the ones issued by the General Medical Council and the School of Surgery, where failure to complete may result in adverse outcomes in the Annual Review of Competency Progression for the training program. Secondly, it could be due to the busy clinical work of trainees where the emergency service out of hours is a mandatory part of the work. In the future, a multi-center study with lead investigators in different regions is likely to improve the response rate.

## Conclusion

Canthotomy and cantholysis is an important skill to have as an ophthalmologist. We found that junior trainees were less confident in the skill and that confidence level grew with more cases performed in both emergency and elective settings and also if an oculoplastic surgery rotation is completed. We recommend from our study that it would be beneficial for junior trainees to start an oculoplastic surgery rotation early although we appreciate that this may not be possible in all hospitals. As an alternative, adding canthotomy and cantholysis as a required portfolio competency at this early stage of training may help the junior trainees to focus on the skillset and encourage the local training bodies to formally support the training in the early stage. This would improve the trainee exposure and thus confidence in this vision-saving procedure.

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## Conflicts of interest

There are no conflicts of interest.

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