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Five-Year Analysis of Indications, Surgical Approach, Orbital Implants, and Clinical Outcomes of Anophthalmic Surgery: The North East England Study

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Research Article

Keywords: anophthalmic surgery, evisceration, enucleation, orbital implants, outcomes

Posted Date: April 1st, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9130699/v1

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Additional Declarations: No competing interests reported.

Abstract

Purpose

To evaluate the indications, surgical approaches, implant use, and outcomes of anophthalmic surgery in the North East of England, to better understand the current

practice.

Methods

This multi-centre, retrospective study reviewed all anophthalmic surgeries performed in the North East of England from 2012 to 2016 across three tertiary centres. Data on patient demographics, indications, surgical types, anaesthesia, orbital implants, histopathology, postoperative care, and complications were collected and analysed.

Results

62 patients (n = 63 eyes) were included in the study with the mean age of 57. A total of n=54 (85.7%) eviscerations and n=9 (14%) enucleations were included, with one patient undergoing bilateral eviscerations. The most common indication for evisceration was painful blind eye (n=38) and for enucleation was intraocular malignancy (n=7). The majority (n=58, 92%) of the anophthalmic procedures were carried out under general anaesthesia and n=2 (3%) were carried out under local anaesthesia. The most common choice of implant included were Silicone and Acrylic. The most commonly chosen size of implant was 20mm, which was used in 42% of the cases. The complications were rare and effectively managed.

Conclusions

Evisceration was the most common anophthalmic surgery, with non-porous silicone implants preferred unless infection was present. Both procedures were safe, highlighting the importance of improved diagnosis and treatment for end-stage ocular diseases.

INTRODUCTION

Therapeutic removal of the eye contents (evisceration), the globe (enucleation), and orbital tissues and/or bones (exenteration), collectively referred to as anophthalmic surgery, is indicated in a range of severe ocular conditions, including intraocular malignancy, devastating ocular trauma, intractable infection, and painful blind eye.[1,2] These procedures may significantly improve quality of life in patients with a blind painful eye and are potentially life-saving in cases of ocular malignancy. Given the profound visual, psychological, and functional consequences of eye loss, a clear understanding of the indications and outcomes of anophthalmic surgery is essential.

Anophthalmic surgery is a relatively uncommon and highly specialised intervention, typically performed by a small number of subspecialist ophthalmic surgeons, most commonly oculoplastic and orbital surgeons. As a result, considerable variation exists in surgical technique, implant selection, and postoperative management. To date, only limited evidence has examined contemporary indications and surgical approaches in anophthalmic surgery,[3] and no population-based analysis has been conducted in the North East of England. In view of this paucity of regional data, the present study aimed to evaluate the prevalence, indications, surgical approaches, implant use, and clinical outcomes of anophthalmic surgery across three tertiary centres in the North East of England over a five-year period.

METHODS

This was a multi-centre retrospective study of all anophthalmic surgeries performed in the North East of England between 1 January 2012 and 31 December 2016. Three tertiary referral centres were included: Royal Victoria Infirmary, Newcastle upon Tyne; James Cook University Hospital, Middlesbrough; and Sunderland Eye Infirmary, Sunderland, serving a combined population of over 2.6 million people.[4] All types of anophthalmic surgery, including evisceration, enucleation, and exenteration, were eligible for inclusion.

Data collected included patient demographics, surgical indication, type of procedure, anaesthetic modality, orbital implant use, histopathological findings (where malignancy was suspected), postoperative management, and complications. Data were extracted from medical case records and collated in a standardised data collection framework.

Statistical analysis was performed using Microsoft Excel. Categorical variables were analysed using Pearson's chi-square test or Fisher's exact test, where appropriate. Continuous variables were analysed using Student's t-test or the Mann–Whitney U test, depending on data distribution.

The study was conducted by members of the North East Trainee Research in Ophthalmology Network (NETRiON), an ophthalmology trainee research collaborative established to promote trainee-led research.[5],[6] This study was conducted as a clinical audit and service evaluation of routine anophthalmic surgical practice across three NHS Trusts. According to UK Health Research Authority guidance, clinical audit and service evaluation projects do not meet the definition of research and therefore do not require review by a Research Ethics Committee or formal HRA approval. The project was registered and approved locally at each participating centre through their clinical governance and audit frameworks (The Newcastle upon Tyne Hospitals NHS Foundation Trust, South Tees Hospitals NHS Foundation Trust and South Tyneside and Sunderland NHS Foundation Trust). No changes to patient management were made for the purposes of this study. All procedures were undertaken as part of standard clinical care. Written informed consent for surgery was obtained from all patients, and the study was conducted in accordance with the tenets of the Declaration of Helsinki.

RESULTS

During the 5-year study period, 62 patients (n = 63 eyes) were included; the mean age was 57.0 ± 20.4 years (range 12–91 years) with a male preponderance (67%) and the age distribution is demonstrated in Fig. 1. A total of n = 54, 85.7% eviscerations and n = 9, 14.2% enucleations were included, with one patient undergoing bilateral eviscerations. No case of exenteration was identified. The most common indication for evisceration was painful blind eye (n = 38) and for enucleation was intraocular malignancy (Table 1). Of all cases of painful blind eye, previous traumatic globe injury (n = 14, 37%) was the most common underlying cause followed by corneal infection (n = 6, 16%), glaucoma (n = 4, 11%), and congenital cause (n = 4, 11%) (for example, congenital glaucoma), amongst others (Fig. 2).

Most of the cases of anophthalmic surgery were elective (n = 44, 70%), with a few infective and traumatic causes requiring urgent surgery (performed within a week of the decision to operate). Only n = 2, (3%) cases were carried out as emergency, within 24 hours of the decision to operate. Histopathologic assessment did not demonstrate any surprising findings such as incidental tumours in any of the tissue samples. Interestingly, none of the patients who have undergone anophthalmic surgery suffered from sympathetic ophthalmia and preventative treatment for the condition is not routinely given at our centres.

Surgical approach and outcomes were closely examined in this study. All the anophthalmic surgeries were carried out by oculoplastic surgeons at the three centres. The majority (n = 58, 92%) of the anophthalmic procedures were carried out under general anaesthesia and n = 2 (3%) were carried out under local anaesthesia, due to patients' anaesthetic risk and co-morbidities, and in 3 cases anaesthetic choice was unknown.

An orbital implant was inserted in n = 48 (76%) cases. Silicone implant n = 16 (33%) was the most common type of orbital implant, followed by acrylic implant n = 15 (31%), Medpor implant n = 5, (10%) and, Bioceramic implant n = 5, (10%) and unknown n = 7 (14) (Fig. 3). The most commonly chosen size of the implant was 20 mm, which was used in n = 23 (48%) cases.

The short-term and long-term post-operative complications of enucleation and evisceration were rare and minor, with the most common complication being socket cyst (n = 4) and socket infection (n = 4). Subsequent secondary procedures were also rare and effectively managed (Table 2). Surgical implant exchange was required in 2 cases, excision of socket cyst in 3 cases, temporary tarsorrhaphy in 2 cases, examination under anaesthesia in 2 cases, lid tightening in 1 case, and dermis graft in 1 case.

The choice of post-operative antibiotic was investigated in this study. 28 patients were covered with post-operative oral antibiotics, with 4 patients already having been started on systemic antibiotics prior to surgery. The most common choice of antibiotic was oral co-amoxiclav (n = 28, 74%), flucloxacillin (n = 6, 16%), ciprofloxacin (n = 3, 8%), cefalexin (n = 1, 3%). Furthermore, there were 4 patients who were already on systemic antibiotics prior to surgery. However, 19 patients were not started on post-operative course of antibiotic. Interestingly, the analysis of post-operative socket infection demonstrated that 3 patients who developed the socket infection have been started on post-operative antibiotics and only 1 patient was found to be not on any post-operative systemic antibiotics.

DISCUSSION

To the best of our knowledge, this study represents the first and largest regional analysis of the prevalence, indications, surgical approaches, and outcomes of anophthalmic surgery in the North East of England. Anophthalmic surgery remains an uncommon yet critical intervention in the management of end-stage ocular disease, including intraocular malignancy and irreversible causes of blind painful eye. The objectives of these procedures are multifaceted: to provide definitive oncological management when required, alleviate pain, restore orbital volume, and optimise cosmetic rehabilitation. The overall number of anophthalmic procedures has declined substantially over the past six decades, largely reflecting advances in ocular diagnostics, medical therapy, and surgical interventions.[7] Changing trends in underlying indications have also been well documented.[7] In particular, glaucoma-related enucleations have decreased significantly with improvements in both pharmacological and surgical management.[8] Public health measures and workplace safety regulations have additionally contributed to a reduction in severe penetrating ocular trauma.

Surgical indications

In our cohort, trauma was the most frequent indication for anophthalmic surgery, followed by infection and intraocular malignancy. This distribution is broadly consistent with reports from tertiary centres in Canada, China, and the United States.[10-12] Differences between cohorts likely reflect regional population characteristics, trauma patterns, access to ophthalmic care, and the underlying incidence of ocular malignancy. The Canadian series identified painful blind eye as the most common overall indication without stratifying underlying aetiology, while both our study and the Chinese series demonstrated trauma as the dominant cause within this category.[10,11] As expected, intraocular malignancy remained the leading indication for enucleation across studies.[10-12]

The commonest indication for anophthalmic surgery in our study was trauma (38%), followed by infection (19%) such as microbial keratitis and endophthalmitis, and intraocular malignancy (11%). Other less common indications include surgical complications, glaucoma-related causes, congenital and inflammatory conditions as well as following orbital radiotherapy to treat sinus squamous cell carcinoma with orbital extension. Similar findings were reported by studies conducted in Canada [10], China [11], and Washington D.C., USA[12] although the Canadian study reported painful blind eye as the commonest indication for both evisceration and enucleation, without providing a breakdown of the underlying cause for this. Canadian authors report that eyes with active infection were more likely to be removed by evisceration compared to other diagnostic groups. They also report that all eyes with evidence of malignancy (clinical or histopathological) were enucleated. Painful blind eye, of which trauma was the commonest cause, was the commonest indication for evisceration in both our study and the Chinese study. Similarly, intraocular malignancy was the commonest indication for enucleation in both studies. Yousuf et al., on the other hand reported trauma as the commonest indication for

enucleation and evisceration[12]. The authors attributed this to the fact that 96% of the study population were African Americans who had an inherently lower incidence of uveal melanoma.

Changing trends in surgical approach

All anophthalmic procedures in our study were performed by subspecialist oculoplastic surgeons, consistent with findings from the UK National Survey demonstrating a shift away from generalist practice.[9] This centralisation reflects increasing subspecialisation, technical complexity, and the importance of coordinated orbital reconstruction.

Evisceration accounted for the vast majority of procedures in our cohort, mirroring national and international trends favouring evisceration over enucleation.[8–13] This shift has been attributed to improved preoperative imaging to exclude occult malignancy, increasing recognition of the rarity of sympathetic ophthalmia, and superior postoperative implant motility following evisceration.[17,18] Yousef et al further demonstrated significantly shorter operative times with evisceration, reducing exposure to general anaesthesia.[12]

Importantly, our findings support the safety of this evolving practice pattern. Complication rates were low and comparable between surgical approaches, and no cases of sympathetic ophthalmia or inadvertent evisceration of malignant eyes were observed. These outcomes are consistent with previous large series.[10,12]

In the setting of ocular trauma, both Holmes et al and Zheng et al reported comparable outcomes between enucleation and evisceration, supporting the use of either approach based on clinical context and surgeon expertise.[19,20]

Orbital implants

The majority of patients in our study received a primary orbital implant, in keeping with national practice.[9] Implant insertion was less frequent in the presence of active infection, reflecting appropriate surgical caution. While porous implants were increasingly popular internationally, non-porous implants predominated in our cohort. Silicone implants were most commonly used, with 20-mm implants preferred, mirroring UK national trends.[9]

The rate of implant exposure in our series was low and compares favourably with previously reported UK data.[9] Although direct comparison between studies is limited by heterogeneity in implant material, surgical technique, and follow-up duration, these findings reinforce the safety of contemporary implant practices in experienced hands.

Use of post-operative prophylactic antibiotics

There is currently no consensus regarding the routine use of postoperative systemic antibiotics in anophthalmic surgery. This was reflected in the variability of prescribing practices across centres in our study. Fay et al demonstrated no significant difference in postoperative infection rates between patients receiving oral antibiotics and those who did not, even in the presence of orbital implants.[21] Pariseau et al reported similarly low infection rates in patients managed without perioperative or postoperative antibiotics.[22]

Our findings are concordant with these data, as postoperative socket infection occurred infrequently and was not clearly reduced by antibiotic use. This highlights the need for further prospective evaluation to guide antimicrobial stewardship in oculoplastic surgery.

Study strengths and limitations

The strengths of this study include its multi-centre design, representation of contemporary UK practice, and detailed evaluation of surgical indications, techniques, and outcomes. Limitations include the retrospective methodology, variability in surgeon practice, and modest sample size. Although no cases of sympathetic ophthalmia were observed, the study was not powered to assess such a rare complication. Future studies incorporating patient-reported outcomes, cosmesis, motility, and quality-of-life measures would provide valuable complementary insight.

Conclusions and future direction

Evisceration was the predominant anophthalmic procedure performed in the North East of England, consistent with national and international trends. Primary orbital implant insertion was common, particularly in non-infective cases, with non-porous implants most frequently utilised. Both evisceration and enucleation demonstrated favourable safety profiles. Anophthalmic surgery continues to play a vital role in the management of end-stage ocular disease, and ongoing improvements in early diagnosis and disease-directed therapies may further reduce the future need for eye removal.

Abbreviations

NHS
National Health Service
NETRiON
North East Trainee Research in Ophthalmology Network

Declarations

Ethics approval and consent to participate

This study was conducted as a clinical audit and service evaluation of routine anophthalmic surgical practice across three NHS Trusts in the North East of England (The Newcastle upon Tyne Hospitals NHS Foundation Trust, South Tees Hospitals NHS Foundation Trust, and South Tyneside and Sunderland NHS Foundation Trust).

According to UK Health Research Authority guidance, clinical audit and service evaluation projects do not require review by a Research Ethics Committee or formal Health Research Authority approval.

The project was registered and approved locally through the clinical governance and audit departments of each participating centre. All procedures were undertaken as part of standard clinical care. Written informed consent for surgery was obtained from all patients. The study was conducted in accordance with the tenets of the Declaration of Helsinki.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due to patient confidentiality but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This study received no external funding.

Authors' contributions

Lyudmila Kishikova conceived and designed the study, coordinated and carried out data collection, performed data analysis and interpretation, and drafted the initial manuscript. Maria Vrahimi and Sinead Connolly contributed to data acquisition, data interpretation, and critical revision of the manuscript for important intellectual content. Darren S J Ting, Adriana Chilinska, Gordon Lau, and Lucy Clarke contributed to study design, data interpretation, and critical revision of the manuscript for important intellectual content. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Acknowledgements

The authors would like to acknowledge the contributions of the North East Trainee Research in Ophthalmology Network (NETRiON) and the clinical teams at the participating centres for their support

in data collection and study coordination.

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Tables

Table 1

Indications	Evisceration	Enucleation
Painful blind eye	38	1
Malignancy	0	7
Perforation	8	0
Traumatic globe rupture	2	1
Poor cosmesis	1	0
Infection	4	0
Unknown	1	0
Total	54	9

Table 1. Indications for anophthalmic surgery by procedure type.
Summary of the clinical indications for surgery, stratified by evisceration and enucleation. Painful blind eye was the most common indication for evisceration (n=38), whereas intraocular malignancy predominated in enucleation cases (n=7).

Table 2

Complications	Number of patients	
	Enucleation	**Evisceration**
Socket cyst		4
Subconjunctival haemorrhage	1	1
Slow wound closure		1
Socket infection		4
Implant exposure		2
Conjunctival prolapse		2
Post-operative swelling		1
Orbital haematoma	1	0
Pain		1
Conjunctival changes		1
Preseptal cellulitis		1

Table 2. Postoperative complications following anophthalmic surgery.
Reported short- and long-term complications after evisceration and enucleation. The most common complications were socket cyst (n=4) and socket infection (n=4). Other events such as implant exposure, subconjunctival haemorrhage, and orbital haematoma were rare and managed effectively

Figures

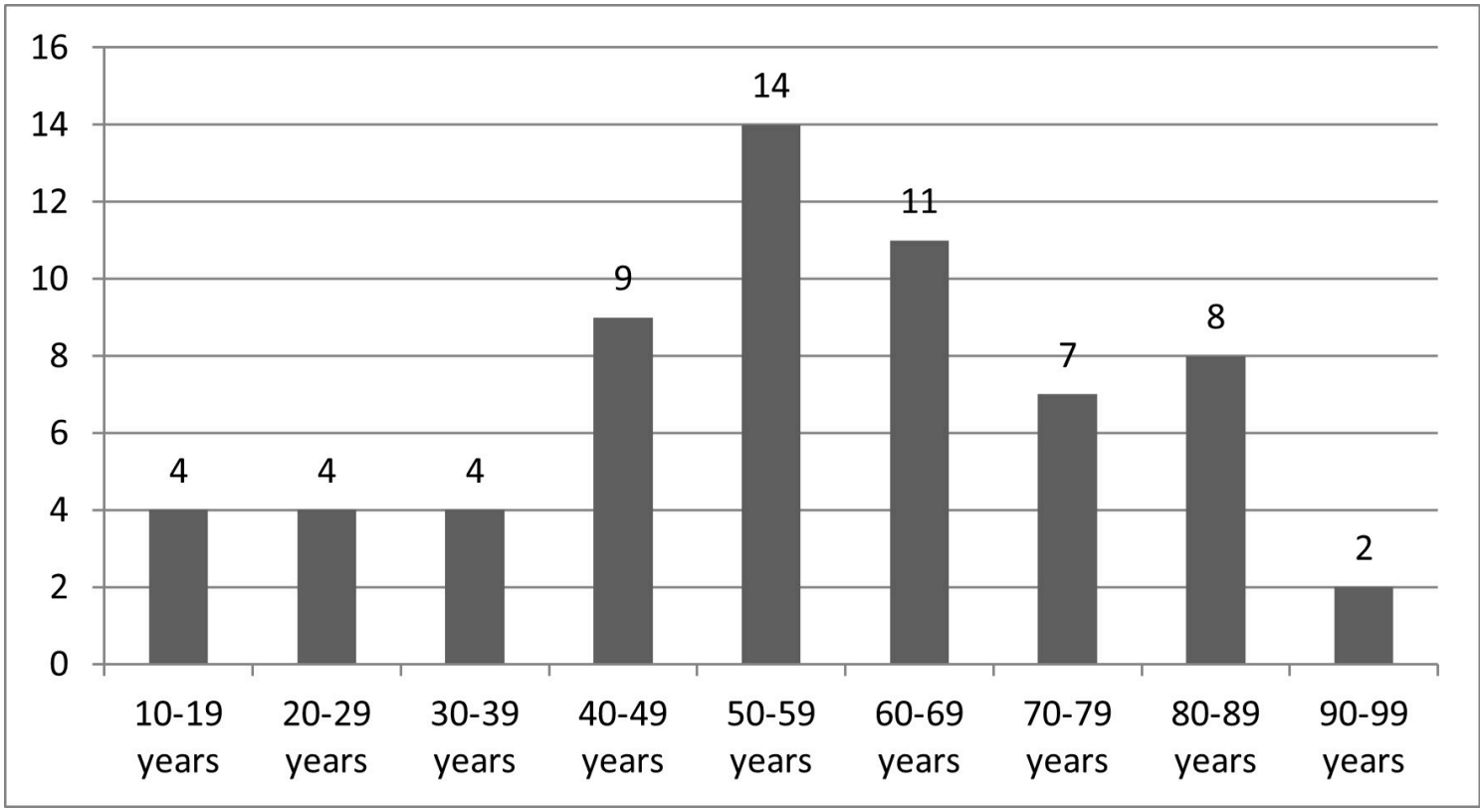


Figure 1

Age distribution of patients undergoing anophthalmic surgery.
Histogram showing the age range (12–91 years) of patients included in the study. The mean age was 57.0 ± 20.4 years, with a male preponderance (67%).

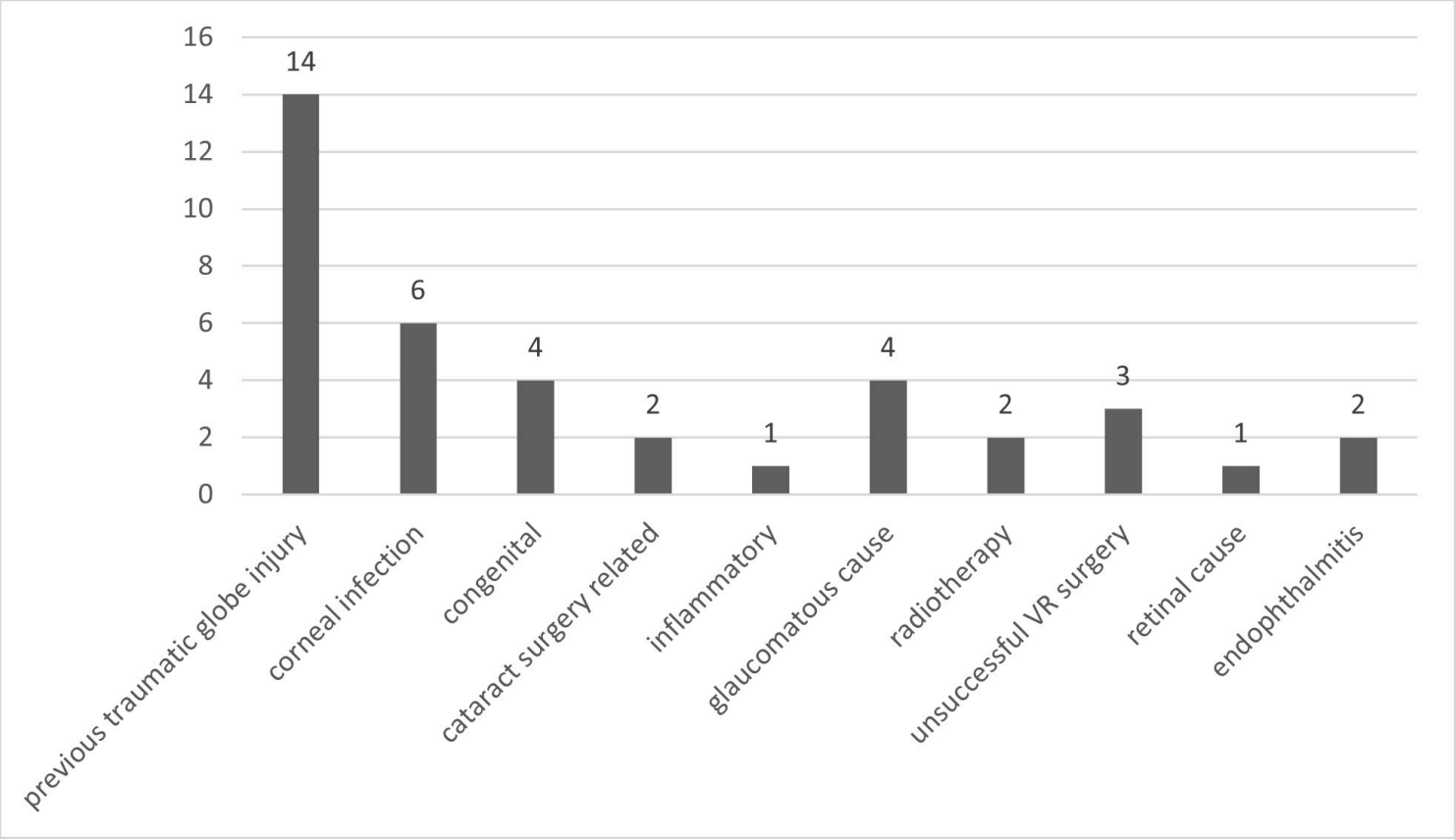


Figure 2

Underlying causes of painful blind eye requiring evisceration.
Previous traumatic globe injury (n=14, 37%) was the most frequent cause, followed by corneal infection (n=6, 16%), glaucoma (n=4, 11%), congenital causes such as congenital glaucoma (n=4, 11%), and other less common aetiologies.

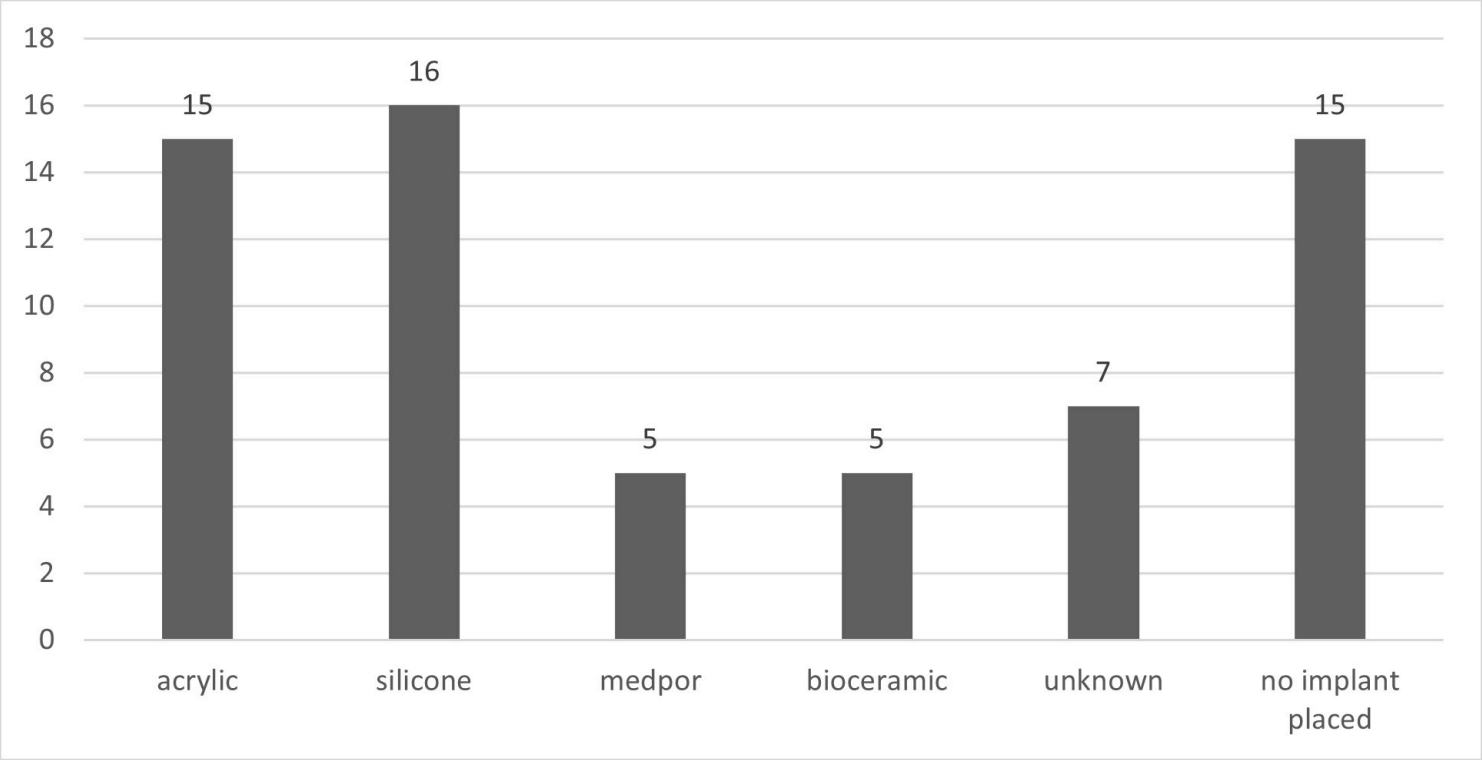


Figure 3

Types and sizes of orbital implants used in anophthalmic surgery.
Most patients (76%) received an orbital implant. Silicone (33%) and acrylic (31%) were the most commonly used materials, followed by Medpor (10%) and bioceramic (10%). The 20 mm implant was the most frequently selected size (48%)