



NOD

**National Ophthalmology
Database Audit**

National Cataract Audit Post-Cataract Surgery Complications

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Document authors

Paul HJ Donachie

John C Buchan

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1 Acknowledgment

The National Ophthalmology Database (NOD) Audit is conducted under the auspices of the Royal College of Ophthalmologists (RCOphth) and conducts both the annual National Cataract Audit and the National Age-related Macular Degeneration Audit.

We acknowledge the support of the hospitals that are participating in the RCOphth NOD and thank our medical and non-medical colleagues for the considerable time and effort devoted to data collection. All participating centres are listed on the RCOphth NOD website (www.nodaudit.org.uk).

2 Introduction

The Royal College of Ophthalmologists (RCOphth) is the governing authority for the National Ophthalmology Database Audit (NOD) and conducts both The National Cataract Audit and The National Age-related Macular Degeneration (AMD) Audit. The National Cataract Audit is open to all providers of National Health Service (NHS) funded cataract surgery and providers of private funded cataract surgery in England, Guernsey, Scotland, Northern Ireland and Wales. The National AMD Audit is open to providers of NHS funded Neovascular AMD treatment with anti-vascular endothelial growth factor (Anti-VEGF) injections. The data is collected as part of routine clinical care on electronic medical record (EMR) systems or in-house data collection systems and the analysis is performed by the RCOphth NOD Audit statisticians based in Cheltenham General Hospital.

Results are published on the RCOphth NOD website (www.nodaudit.org.uk), are provided to the Care Quality Commission and written up for publication in peer reviewed journals and annual reports. Centre level results include operations performed by trainee surgeons, but trainees are not included in the publicly available named surgeon level results.

Post-cataract surgery complications can occur at different points of time after cataract surgery, and the data could be recorded on different parts of the data collections systems. The main ophthalmic EMR systems have a section for recording the standard post-operative complications for ophthalmic treatment, while data for the occurrence of a complication could be recorded as a diagnosis, an indication for further surgery, as treatment data or as ocular measurements. Certain post-cataract surgery complications would lead to the patient attending the eye hospital immediately, whilst others may not be detected until the patient attends their post-surgery assessment.

This document details the inferring from all parts of the post-cataract surgery data supplied to the National Cataract Audit that applies to the post-cataract surgery complications the audit reports. This inferring applies to cases of post-cataract surgery complications, and not to the absence or non-occurrence. This is because the submitted data is for occurrence and not avoidance of individual post-cataract complication unless “none” is recorded. If an eye had post-cataract surgery diagnosis data for something other than any of the post-cataract surgery complications, this is not inferred as no post-cataract surgery complication, otherwise the estimate of recorded or not-recorded post-cataract surgery complications is over-inflated.

As the RCOphth NOD receives data collected on multiple systems that can have different ways to record information, the terminology used in this document is the wording used in the supplied information.

3 Post-cataract surgery complications

The following post-cataract surgery complications are considered to have occurred if recorded as a post-operative complication within 3 months of cataract surgery, except for post-cataract presumed infectious endophthalmitis which is only considered if within 42 days;

- Choroidal Effusion / Detachment
- Corneal Oedema / Striae / Haze
- Cystoid Macular Oedema
- Diplopia
- Eyelid Oedema
- Hyphaema
- Hypotony
- IOL Decentred
- Iris to the wound / Prolapse
- Other
- Post-operative Scleritis
- Post-operative Uveitis
- Presumed Infectious Endophthalmitis
- Ptosis
- Raised IOP (>21 mmHg)
- Retained Lens Matter
- Retinal Detachment
- Unexpected Refractive Outcome
- Vitreous Haemorrhage
- Vitreous in the AC / Section

4 Post-cataract surgery treatment and ocular assessments

From post-cataract surgery ocular assessments and treatment data, the following post-cataract surgery complications can be considered to have occurred if recorded within 3 months of cataract surgery;

- If the eye has an intra ocular pressure (IOP)_measurement of >21 mmHg then the eye is considered to have experienced “Raised IOP (>21 mmHg)”.
- If the eye has a record of a surgery that included IOL reposition then “Decentred IOL” is considered to have occurred.
- If the eye has a record of a surgery that included either removal of retained lens nucleus or removal of retained lens fragments, then “Retained Lens Matter” is considered to have occurred.
- If the eye has a record of a surgery that included either anterior vitrectomy or YAG vitreolysis, then “Vitreous in the AC / Section” is considered to have occurred.

From post-cataract surgery ocular assessments and treatment data, the following post-cataract surgery complication is considered to have occurred if recorded within 42 days of cataract surgery;

- If the eye has a record of a surgery that included an anterior chamber tap or vitreous biopsy then “Presumed Infectious Endophthalmitis” is considered to have occurred.
- If the eye has a record of an IVI antibiotic injection, then “Presumed Infectious Endophthalmitis” is considered to have occurred.

5 Post-cataract surgery diagnosis and indication for treatment

The following diagnostic terms can be recorded on the contributing EMR systems as either a diagnosis or an indication for surgery. The RCOphth NOD uses the recording of this information to infer the occurrence of the listed post-cataract surgery complications if recorded within 3 months of cataract surgery, except for post-cataract presumed infectious endophthalmitis which is only considered if within 42 days. All wording is as in the information that has been supplied to the RCOphth NOD.

Choroidal Effusion / Detachment

- Choroidal detachment
- Choroidal effusion

Corneal Oedema / Striae / Haze

- Corneal oedema
- Corneal stroma striae
- Hazy cornea
- Post-operative corneal oedema
- Pseudophakic corneal oedema

Cystoid Macular Oedema

- Cystoid macular oedema

Diplopia

- Binocular diplopia
- Diplopia
- Intractable diplopia

Hyphaema

- Hyphaema
- Hyphaema completely filling anterior chamber
- Hyphaema filling $< 1/3$ of anterior chamber
- Hyphaema filling $< 2/3$ of anterior chamber
- Microscopic hyphaema
- Microscopic post-operative hyphaema
- Post-operative hyphaema completely filling ac
- Post-operative hyphaema filling $< 1/3$ of ac
- Post-operative hyphaema filling $< 2/3$ of ac

Hypotony

- Hypotony

IOL Decentred

- Pseudophakic IOL decentred

Iris to the wound / Prolapse

- Iris prolapse
- Iris to wound

Post-operative Scleritis

- Brawny scleritis
- Choroidal folds associated with scleritis
- Diffuse anterior scleritis
- Localised anterior scleritis
- Necrotising scleritis
- Nodular scleritis
- Orbital scleritis

- Posterior scleritis
- Scleritis
- Superficial scleritis

Post-operative Uveitis

- 1+ vitreous inflammation
- 2+ vitreous inflammation
- Acute and subacute iridocyclitis
- Acute anterior uveitis
- Acute iritis
- Anterior uveitis
- Chronic anterior uveitis
- Cyclitis
- Herpes Zoster / Shingles
- Inflammatory disorder of the eye
- Intermediate uveitis
- Immune recovery uveitis
- Iritis
- Keratouveitis
- Macular oedema associated with uveitis
- Non-infectious anterior uveitis
- Pars planitis
- Phacoantigenic uveitis
- Posterior uveitis
- Post-operative uveitis
- Sclerouveitis
- Subacute anterior uveitis
- Subacute iritis
- Sympathetic uveitis
- Uveitic glaucoma
- Uveitis
- Uveitis related cystoid macular oedema

- Vitreous inflammation
- Vitreous inflammation - red reflex present

Presumed Infectious Endophthalmitis

- 3+ vitreous inflammation
- 4+ vitreous inflammation
- Aspergillus endophthalmitis
- Endophthalmitis
- Infective uveitis
- Panophthalmitis
- Panuveitis
- Post-operative endophthalmitis

For both 3+ and 4+ vitreous inflammation, PIE is not assumed if there is a record of vitritis prior to cataract surgery

Ptosis

- Involutional ptosis
- Mechanical ptosis
- Post-operative ptosis
- Ptosis
- Ptosis due to simple superior rectus weakness
- Ptosis repair aponeurotic repair
- Ptosis repair brow suspension
- Ptosis repair levator resection
- Ptosis repair levator transposition
- Ptosis repair levator weakening
- Ptosis repair other
- Ptosis repair tarso-conjunctival resection

Raised IOP (>21 mmHg)

- Raised intraocular pressure

Retained Lens Matter

- Retained soft lens matter in the capsular bag

Vitreous Haemorrhage

- 1+ vitreous haemorrhage
- 2+ vitreous haemorrhage
- 3+ vitreous haemorrhage
- 4+ vitreous haemorrhage
- Vitreous haemorrhage – no red reflex
- Vitreous haemorrhage – red reflex present

Vitreous in the AC / Section

- Vitreous in the anterior chamber
- Vitreous to the section

6 Rhegmatogenous retinal detachment as a postoperative complication

In the National Cataract Audit the different forms of retinal detachment (RD) can be separated with the focus on rhegmatogenous RD than exudative or tractional RD as an ocular co-pathology / known risk factor.

Rhegmatogenous RD (RRD) is identified from different stages of the patient pathway, as not all centres submit data for every assessment from all areas of the hospital eye service where data could be recorded for RRD. Depending on the implementation of the EMR across a hospital's eye service, diagnoses of RRD could be recorded without the data for the surgery, or vice versa, or RRD could only be recorded as a postoperative complication.

To identify RRD the relevant parts of data are;

- Postoperative complication data
- Diagnostic data (diagnosis and indication for surgery)
- Surgery data

Once all possible records are processed, the RRD data can be matched to the cataract surgery data to identify pre-cataract and post-cataract RRD.

Postoperative complication data:

RRD is identified from a postoperative complication records of retinal detachment

Diagnostic data (diagnosis and indication for surgery):

Diagnosis / Indication for surgery data is used to identify definite RRD, possible RRD and exudative or tractional RD. The same approach is used for both diagnosis data and indication for surgery data as there is a common coding structure on the RCOphth NOD for these two parts of clinical data. The clinical terms listed below use the internal RCOphth NOD coded labelling.

Definite RRD diagnoses / indication for surgery:

- 1 quadrant of retina detached
- 2 quadrants of retina detached
- 3 quadrants of retina detached
- 4 quadrants of retina detached
- Chronic rhegmatogenous retinal detachment
- Chronic rhegmatogenous retinal detachment - macula off
- Chronic rhegmatogenous retinal detachment - macula on
- Largest tractional tear < 1 clock hour
- Largest tractional tear > 1 clock hour
- Retinal detachment
- Retinal detachment associated with myopia
- Rhegmatogenous retinal detachment
- Rhegmatogenous retinal detachment - macula off
- Rhegmatogenous retinal detachment - macula on
- Rhegmatogenous retinal detachment associated with myopia
- Rhegmatogenous retinal detachment (primary)
- Rhegmatogenous retinal detachment (1 previous operation for RD)
- Rhegmatogenous retinal detachment (2 previous operations for RD)
- Rhegmatogenous retinal detachment (> 2 previous operations for RD)
- Tractional (horse-shoe) tear

Possible RRD diagnoses / indication for surgery:

- Cause of failed retinal detachment surgery unknown
- Cryo / buckle retinal detachment repair
- Largest retinal break 0.5 clock hours
- Largest retinal break 1 clock hour
- Largest retinal break 2 clock hours
- Largest retinal break 3 clock hours
- Largest retinal break 4 clock hours
- Largest retinal break 5 clock hours

- Largest retinal break 6 clock hours
- Largest retinal break 7 clock hours
- Largest retinal break 8 clock hours
- Largest retinal break 9 clock hours
- Largest retinal break 10 clock hours
- Largest retinal break 11 clock hours
- Largest retinal break 12 clock hours
- Low buckle indent
- No visible buckle indent
- PVR caused failed retinal detachment surgery
- PVR grade A
- PVR grade B
- PVR grade C
- PVR grade CA1
- PVR grade CA2
- PVR grade CA3
- PVR grade CA4
- PVR grade CA5
- PVR grade CA6
- PVR grade CA7
- PVR grade CA8
- PVR grade CA9
- PVR grade CA10
- PVR grade CA12
- PVR grade CP1
- PVR grade CP12
- PVR grade CP2
- PVR grade CP3
- PVR grade CP4
- PVR grade CP5
- PVR grade CP6
- PVR grade CP7

- PVR grade CP8
- PVR grade CP9
- PVR grade CP10
- PVR grade CP11
- Secondary open angle glaucoma (retinal detachment)
- Successfully treated retinal detachment
- Treated retinal break re-opening caused failed retinal detachment surgery
- Untreated retinal break caused failed retinal detachment surgery
- Unsuccessfully treated retinal detachment
- Vitrectomy retinal detachment repair

Exudative or Tractional RD diagnoses / indication for surgery:

- Combined tractional/rhegmatogenous retinal detachment associated with diabetic retinopathy
- Exudative retinal detachment
- Exudative retinal detachment associated with age-related macular degeneration
- Exudative retinoschisis
- Macula off tractional retinal detachment associated with diabetic retinopathy
- Macula on tractional retinal detachment associated with diabetic retinopathy
- Proliferative sickle cell retinopathy stage V (tractional retinal detachment)
- Serous retinal detachment
- Tractional retinal detachment
- Tractional retinal detachment associated with diabetic retinopathy
- Tractional retinal detachment associated with diabetic retinopathy - fovea detached
- Tractional retinal detachment associated with diabetic retinopathy - fovea not threatened
- Tractional retinal detachment associated with diabetic retinopathy - traction on fovea

For eyes with data for >1 of the groups on the same date, the following allocation order applies:

- Definite RRD supersedes possible RRD
- Exudative or Tractional RD supersedes either definite RRD and possible RRD

This reduces the diagnostic information to one of the groups for each date the eye has this data recorded for.

Surgical procedures data:

Surgery procedure data is used to identify definite RRD surgery and possible RRD surgery by first creating binary variables from the surgical procedure data and then applying a hierarchical allocation. The binary variables created are displayed in Table 1;

Table 1: Binary variable created from surgical procedures data

Surgical procedures terminology on NOD	Binary variable
Scleral buckle – circumferential Scleral buckle – encircling Scleral buckle - radial	Buckle
Pars plana vitrectomy	PPV
Internal tamponade – air Internal tamponade - c2f6 gas Internal tamponade - c3f8 gas Internal tamponade - sf6 gas Internal tamponade - heavy liquid Internal tamponade - heavy silicone oil (densiron) Internal tamponade - silicone oil	Tamponade
Retinopexy – endolaser Retinopexy - 360-degree laser Retinopexy - indirect laser Retinopexy – cryotherapy Cryotherapy to lesion of retina Retinopexy - trans-scleral diode laser Retinopexy - other	Laser
PVR membrane peel	PVR peeling
Drainage of subretinal fluid through retina Retinotomy – drainage Retinectomy Retinotomy – relieving	Drainage

Drainage of subretinal fluid through sclera Drainage of supra-choroidal haemorrhage	
Automated anterior vitrectomy Sponge and scissors vitrectomy	Other Vitrectomy
Pneumatic retinopexy	Pneumatic
Maintenance of implant in sclera Scleral buckle – removal Scleral buckle - revision / replacement Removal of silicone oil Removal of tamponading agent	Removal
Fibrovascular membrane delamination Fibrovascular membrane segmentation	Fibrovascular
Epiretinal membrane peel	ERM peeling
Internal limiting membrane peel	ILM peeling
Subretinal membrane / band removal	Other

Using the binary variables detailed in Table 1, each eye is allocated in the specified order below to either definite RRD surgery or possible RRD surgery, and during this allocation point, once allocated their status does not change. Only the binary variables listed for each allocation are used, if a binary variable is not listed, then this is when this is not listed (variable = 0), for example if Laser is not listed, then the relevant row in the allocation is when no laser was recorded.

The structure below uses the name allocated to the binary variable outlined in Table 1.

Not RRD surgery:

- Eyes where all binary variables = 0
- Eyes with only Other Vitrectomy
- Eyes with no Buckle or PPV ± Other Vitrectomy
- Eyes with only PPV + Removal
- Eyes with PPV with no laser and no tamponade
- Eyes with only PPV + Tamponade + ERM peeling
- Eyes with only PPV + Tamponade + ILM peeling
- Eyes with only PPV + Tamponade + ERM peeling + ILM peeling
- Eyes with Fibrovascular

Definite RRD surgery:

- Eyes with Buckle
- Eyes with Pneumatic
- Eyes with PPV + Tamponade + Laser ± Drainage ± PVR peeling ± Removal ± ERM peeling ± ILM peeling ± Other Vitrectomy ± Other
- Eyes with PPV + Tamponade + PVR peeling ± Drainage ± Removal ± Other Vitrectomy ± Other
- Eyes with PPV + Tamponade + Drainage ± PVR peeling Removal ± Other Vitrectomy ± Other
- Eyes with PPV + Tamponade + Removal ± PVR peeling ± Drainage ± Other Vitrectomy ± Other
- Eyes with PPV + Laser + PVR peeling ± Drainage ± Removal ± Other Vitrectomy ± Other
- Eyes with PPV + Laser + Drainage ± PVR peeling ± Removal ± Other Vitrectomy ± Other
- Eyes with PPV + Laser + Removal ± PVR peeling ± Drainage ± Other Vitrectomy ± Other
- Eyes with Gas Tamponade + Retinopexy without PPV

Possible RRD surgery:

- Eyes with PPV + Tamponade + ERM peeling + (any of drainage, PVR peel, Removal, Other Vitrectomy or Other)
- Eyes with PPV + Tamponade + ILM peeling + (any of drainage, PVR peel, Removal, Other Vitrectomy or Other)
- Eyes with PPV + Tamponade + ERM peeling + ILM peeling + (any of drainage, PVR peel, Removal, Other Vitrectomy or Other)
- Eyes with PPV + Laser + ERM peeling + (any of drainage, PVR peel, Removal, Other Vitrectomy or Other)
- Eyes with PPV + Laser + ILM peeling + (any of drainage, PVR peel, Removal, Other Vitrectomy or Other)
- Eyes with PPV + Laser + ERM peeling + ILM peeling + (any of drainage, PVR peel, Removal, Other Vitrectomy or Other)
- Eyes with PPV + Laser + ERM peeling only ± removal

- Eyes with PPV + Laser + ILM peeling only ± removal
- Eyes with PPV + Laser + ERM peeling + ILM peeling only ± removal
- Eyes with PPV + Tamponade + Other Vitrectomy only
- Eyes with PPV + Laser + Other Vitrectomy only
- Eyes with PPV + Tamponade + Other only
- Eyes with PPV + Laser + Other only
- Eyes with PPV + Tamponade only
- Eyes with PPV + Laser only

Combining data sources for final identification:

Allocation when dates match:

When the diagnostic and surgical data is recorded on the same date, definite RRD from either source allocates this episode to be RRD.

When the postoperative complication record is recorded for the same date as a diagnostic record for possible RRD, this episode is allocated as RRD.

Allocation when dates are within a plausible time period that could be for the same RRD episode:

When the diagnostic record is recorded within two weeks prior to the surgical record, these records are assumed to be for the same RRD episode, to account for diagnosis on one day with listing and surgery on another day. Similarly, when the diagnostic record is up to 7 days after the surgery record, to account for 'soon after' data entry, amendment or reviewing of recorded data.

When the diagnostic or surgical record is recorded within two weeks after the postoperative complication record, these records are assumed to be for the same RRD episode with the diagnosis and/or surgery data assumed to be for dealing with the RRD as a postoperative complication of an earlier surgery.

In these situations, definite RRD from any source allocates this episode to be RRD.

Allocation with dates do not match or are outside of plausible same event time period:

When the records do not match on dates or are outside of the plausible time period for the same RRD episode, then postoperative complication records of RRD, diagnostic and surgical records of definite RRD allocate the episode to be RRD, while records for possible RRD allocate the episode to not RRD.

7 Pre-cataract surgery record of the post-surgery complication

If any of the following post-cataract surgery complications are recorded prior to surgery, then the post-surgery record is changed to 'none' under the assumption that the post-surgery record is for an existing problem, and not a new occurrence for the post-surgery complication. For some of these, the pre-cataract record is only considered if within a specified time period prior to cataract surgery;

- Choroidal Effusion / Detachment
- Corneal Oedema / Striae / Haze
- Cystoid Macular Oedema
- Diplopia
- Eyelid Oedema
- Hyphaema
- Hypotony
- Iris to the wound / Prolapse
- Ptosis
- Raised IOP (>21 mmHg)
- Retinal Detachment
- Vitreous Haemorrhage

Summarized in Table 2 is information for each post-cataract surgery complication regarding if inferred or not considered if recorded pre-cataract surgery. For the not considered if recorded pre-cataract surgery criteria, the time period that applies is provided.

Table 2: Information for which post-cataract surgery complications inferring and not considering if also recorded pre-cataract surgery

Post-cataract surgery complication	Infer from diagnosis and indication for surgery	Infer from treatment and ocular assessments	Not consider if recorded pre-cataract surgery
Choroidal Effusion / Detachment	Yes	No	Yes (within 2 years prior to cataract surgery)
Corneal Oedema / Striae / Haze	Yes	No	Yes (within 2 years prior to cataract surgery)
Cystoid Macular Oedema	Yes	No	Yes (within 1 year prior to cataract surgery)
Diplopia	Yes	No	Yes (within 1 year prior to cataract surgery)
Eyelid Oedema	No	No	Yes
Hyphaema	Yes	No	Yes
Hypotony	Yes	No	Yes
IOL Decentred	Yes	Yes (from surgery records)	N/A
Iris to the wound / Prolapse	Yes	No	Yes
Other	No	No	No
Post-operative Scleritis	Yes	No	No
Post-operative Uveitis	Yes	No	No
Presumed Infectious Endophthalmitis	Yes	Yes (from surgery records)	No
Ptosis*	Yes (limited selection only)	No	Yes
Raised IOP (>21 mmHg)	Yes	Yes (from IOP measurements)	Yes
Retained Soft Lens Matter	Yes	Yes (from surgery records)	N/A

Retinal Detachment	Yes	Yes (from surgery records)	Yes (within 3 months prior to cataract surgery)
Post-operative Scleritis	Yes	No	No
Unexpected Refractive Outcome	No	No	N/A
Vitreous Haemorrhage	Yes	No	Yes
Vitreous in the AC / Section	Yes	Yes (from surgery records)	N/A

*For not considering if recorded prior to cataract surgery the following diagnostic terms are used for pre-cataract ptosis

- Aberrant innervation of III nerve associated with ptosis
- Aberrant innervation of VI nerve associated with ptosis
- Aberrant innervation of VII nerve associated with ptosis
- Blepharophimosis epicanthus inversus ptosis syndrome
- Congenital neurogenic ptosis
- Congenital simple ptosis
- Involutional ptosis
- Mechanical ptosis
- Myopathic ptosis
- Myopathic ptosis due to CPEO
- Neurogenic ptosis
- Post-operative ptosis
- Ptosis
- Ptosis associated with congenital jaw wink
- Ptosis due to a III nerve palsy
- Ptosis due to anophthalmic socket
- Ptosis due to chronic progressive external ophthalmoplegia
- Ptosis due to congenital Horner syndrome
- Ptosis due to congenital simple double elevator palsy
- Ptosis due to Horner syndrome
- Ptosis due to mitochondrial myopathy
- Ptosis due to myasthenia

- Ptosis due to myotonic myopathy
- Ptosis due to oculopharyngeal myopathy
- Ptosis due to simple superior rectus weakness
- Ptosis due to trauma
- Ptosis due to unspecified myopathy
- Ptosis due to unspecified neurogenic cause
- Ptosis repair aponeurotic repair
- Ptosis repair blepharophimosis
- Ptosis repair brow suspension
- Ptosis repair levator resection
- Ptosis repair levator transposition
- Ptosis repair levator weakening
- Ptosis repair other
- Ptosis repair tarso-conjunctival resection