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Original Research Article

Incidence, Clinical Profile and Prognostic Indicators for Visual Outcome in Traumatic Cataract Surgery in Yemen.

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Abstract

Background: Traumatic cataract is an important cause of monocular blindness. It poses a formidable challenge to ophthalmologists for achieving optimal visual acuity as visual prognosis shows highly unpredictability and the injured lens is not the only determining of visual outcome.

Objective: The study was conducted to assess the incidence, clinical characteristics, and prognostic indicators for visual outcomes in traumatic cataract surgery.

Methodology: Medical records of 832 patients presented with traumatic cataract and underwent surgical intervention during the study period at Magrabi Eye Hospital, Sana'a, Yemen were reviewed retrospectively. χ^2 test, odds ratios, and 95% confidence intervals were used to figure out the prognostic factors for visual acuity ≥ 6/18 at final follow-up after cataract surgery.

Results: The incidence rate of cataract was 0.78 %, or 7.8, patients per 1000 patients of eye OPD. The mean age was 20.51 ± 13.16 SD years old with the majority (83.5%) were ≤ 30 years old and 42.9% ≤18 years old. Males were 82.6%. Open globe injury was the most prevalent trauma type (70%). Cornea damage was the predominant concurrent injury in (58.2%). Anterior capsule rupture

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presented in 32.3% and was statistically indicator for presence in 46.7% of 122 eyes with posterior capsule rupture (χ^2 = 13.64, p = < 0.001). Anterior surgical cataract removal approach performed in 61.4% and 38.6% performed pars plana vitrectomy with lensectomy (PPLV). Intraocular lens implanted 75.6%, with 89.5% placed at capsular bag. Posterior capsule opacity was the most late postoperative complication (8.3%). 47% of eyes achieved ≥ 6/18 and 27% were blind in the injured eye < 3/60. Better initial visual acuity (VA) was statistically significant indicator for achieving final VA≥ 6/18, (χ^2= 29.4, p = <0.001). Correlation was found between final VA ≥ 6/18 and age and sex, female patients and younger than 18 years old had the best prognosis. Closed globe injury had satisfactory final VA ≥ 6/18 in 58% comparing to open globe injury 46.3%, (χ^2= 8.944, p = 0.003). Retinal detachment, endophthalmitis, vitreous hemorrhage, posterior capsule rupture or IOFB and no IOL implanted carried the poorest prognosis for final VA ≥ 6/18, (p = <0.001). A statistically favorable final VA ≥ 6/18 was obtained in anterior approach cataract removal than PPLV (χ^2= 102.3, p = < 0.001), capsular bag IOL than non PCIOL (χ^2= 11.5, p = < 0.001) and primary IOL than secondary IOL implantation (χ^2= 9.9, p = 0.002). No difference was detected between simultaneous globe repair with cataract removal and two-step surgical procedure (χ= 0.926, p = 0.336). Posterior segment complications and significant corneal scaring were responsible for blind eyes (<3/60) in 72% and 39.1% respectively, (p = <0.001).

Conclusion: Traumatic cataract remains a frequent sequel of ocular injuries with nearly one third of patients have monocular blindness with the overwhelming predominance of male, age group (1-30) years old, and open globe injury. About half of cases have a satisfactory vision after surgical intervention. The worst indicator factors for poor visual outcome are initial VA ≤ 1/60, open globe injury, coexisting posterior segment pathology, posterior capsule rupture, and remained the eye aphakia.

Keywords: Traumatic Cataract, Ocular Morbidities, Cataract Surgery, Visual Outcome, Yemen.

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Introduction

Human crystalline lens has unique structure and function that are essential for normal eye function and visual system. Despite its typical anatomical and well protected position, up to 65% of eye traumas lead to cataract formation [1]. Ocular trauma is the most common presentation among ocular emergency, nearly 75% [2]. Traumatic lens damage is caused by mechanical injury (blunt and penetrating) and by physical forces such as chemicals and electrical current [3]. Lens opacification is either an acute event or as a late sequela [3]. Hence, patients may present to the ophthalmologist immediately after sustaining an injury or a long time after the injury.

Several studies draw attention to the demographic profile of traumatic cataract that affects patients of all ages, particularly younger than 30 or 40 years old with male predominance [4]. Trauma is the most common cause of unilateral cataract in children [5]. The main treatment of traumatic cataract is surgical removal with intraocular lens (IOL) implantation. In contrast to the high success rate of age-related cataract surgical removal, traumatic cataract poses a formidable challenge to ophthalmologists for restoring vision or achieving optimal visual acuity and preventing vision impairment [3,6,7]. The major obstacle to achieve that goal is concomitant injuries, such as corneal scar and posterior segment involvement. Additionally, the presence of inflammation, elevated intraocular pressure, ability to follow up, an afferent pupillary defect, posterior capsular tear, iridodialysis, zonulolysis, and poor visualization, are linked consistently to greater risk of poor visual outcomes [3,6,7]. Further, obtaining reliable intraocular lens (IOL) power calculation and implanting intraocular lens (IOL) due to irregular cornea and absence of adequate capsular support, respectively, are important challenges [3,6,7]. The aphakic eye and amblyopia have to be addressed carefully, particularly in an immature visual system [3,6,7]. Obviously, the prognosis of visual gain following surgery for traumatic cataracts is a complex issue.

The literature is full of studies on the clinical characteristics and outcomes of traumatic cataract either among pediatric or adults, whereas very little data exists about the incidence and visual prognostic indicators of traumatic cataract among all ages [7,8]. Moreover, eye injury has been studied scantily in Yemen, with no studies on traumatic cataract. For those reasons, the current study was conducted in Sana'a City at Magrabi Eye Hospital, the main tertiary eye hospital in Yemen, to assess the incidence, clinical profile, and prognostic indicators for visual outcome in traumatic cataract surgery.

Material and Methods

This retrospective hospital-based study analyzed medical records of all patients who presented with traumatic cataract and underwent surgical intervention from 26th March 2015 to 26th March 2019 at Magrabi Eye Hospital, Sana'a, Yemen. A total of 4,806 patients with recent eye injuries were documented and 1,367 patients' eyes were diagnosed as traumatic cataract during the research period. Only 843 patients, who had performed eye surgical intervention, were selected. Traumatic cataract cases post rupture globe repaired with NPL, cataract for

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observation, patients Left Against Medical Advice (LAMA), old trauma cases and those with early loss to follow up were excluded. The parameters extracted from the medical files were recorded in a structured questionnaire, which included patient demographic information (age, sex and occupation), laterality, trauma details (etiology, type of trauma, patient location at time of injury and causative agents), associated ocular damage, initial and final visual acuity, surgical procedures, IOL implantation, and complications.

For the suitable presentation of the causative agents, some causative agents with similar characteristics were classified into one group. Objects such as bomb, mine, mortar shell, missile, fireworks, TNT, light bulb, chemical acid battery, and lighter were included together in one group of secondary explosion. On the other hand, objects such as metallic fragment, scissors, knives, syringe/sawing needles, nails, steel rod, and metal wire were included together in one group of metallic or steel objects. Besides, pencils and rulers were classified together as one group of school supplies. Moreover, hand blow, leg kick, fingers fist, body blow, wooden stick, tree branch, door, and thorn were included in the wood objects group.

Most patients were assessed preoperatively, which included trauma history, physical eye examination, and intraocular lens power calculation with ultrasound biometry. Wherever IOL power calculation was not possible in the injured eye, it was performed using the biometry of the fellow eye. B-scan and other relevant investigations: CT scan, slit lamp photography, and VEP were also done, and routine investigations were also made before surgery for general medical condition.

With the exception of traumatic uveitis and rising IOP presentations that were initially treated with topical steroids and cycloplegics and intraocular pressure (IOP) lowering agents, the main management of traumatic cataract was surgical removal. Various surgical interventions were performed under local or general anesthesia by different subspeciality surgeons; anterior segment, pediatric or vitreoretinal, and depend on the status of traumatic cataract. Initially, anatomical integrity of the globe was restored, except in cases with ruptured anterior capsule with lens material into the anterior chamber. Lens aspiration and IOL implantation has been performed at the time of primary repair of corneal laceration. Otherwise, a two-step surgical approach was performed and traumatic cataract surgery is performed months after primary repair.

The standard surgical procedure performed was lens aspiration or phacoemulsification through limbal incision with posterior chamber IOL implantation. Lens aspiration, primary posterior capsulotomy, anterior vitrectomy with posterior chamber IOL implantation was the major procedure done in patients below 5 years old. Extracapsular cataract extraction (ECCE) and PCIOL was performed in hard cataract or with lenticular subluxation or partial zonulolysis. Cases of intraocular foreign body (IOFB) or retinal detachment association or posterior lens dislocation, pars plana lensectomy and vitrectomy (PPLV) was done. In cases with marked lenticular subluxation and/or with

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zonular dialysis of more than half or anterior lens dislocation, intra-capsule cataract extraction (ICCE) with anterior vitrectomy was performed. An anterior vitrectomy was performed when preoperative or intraoperative posterior capsule rupture, vitreous prolapse was determined. Primary posterior chamber intraocular lens (PCIOL) implantation was performed only in patients with adequate capsular support or into the sulcus in patients with inadequate capsular-bag support with adequate remnant of anterior capsule. Patients without any capsular support and children below one year were kept aphakic. Anterior chamber IOL was implanted in dislocated cases and as secondary operation after three months. In addition, Scleral-fixated IOL (SFIOL) was performed as secondary operation in patients with inadequate capsular support.

The study was approved by the Research and Ethics committee of Yemen Magrabi Eye Hospital, and the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional), and with the Helsinki Declaration of 1975, as revised in 2000. The risks of surgical intervention were fully explained to the patients or their guardians in accordance with the Declaration of Helsinki, and verbal informed consent was obtained for inclusion in the study.

Data analysis was carried out using IBM-SPSS version 21. Frequencies and percentages were calculated for categorical data. Chi square test was employed to evaluate the role of each variable and odds ratios (ORs). 95% confidence intervals (CIs) were computed to evaluate the strength of association between various independent factors, such as age, gender, type of ocular injury, associated ocular damage, initial visual acuity, surgical procedures, IOL implantation and complications, with the dependent variable was vision ≥ 6/18 at final follow-up after cataract surgery. P-value of less than >0.05 was considered significant. Visual acuity less than 3/60 was considered as blind in the injured eye according to WHO.

Results

There were 175,655 new cases registered at OPD clinic during the study period in which 5,264 (2.99%) cases presented with ocular trauma with different causes. Only 1,367/5,264 (26%) eyes were accounted to traumatic cataract and only 843 eyes underwent cataract surgery, (61.7%). The incidence rate of cataract was 0.78 % or 7.8 patients per 1,000 patients of eye OPD. There was a unilateral traumatic cataract preponderance with 821 patients (98.7%), and bilateral involvement of both eyes' with 11 patients (1.3%). There was no difference between right and left eye involvement, 49.8% vs 50.2% respectively.

Demographics

A total of 843 eyes of 832 traumatic cataract patients were included in the study. The mean age of the patients was 20.51 ± 13.16 SD years old, ranging between 1 and 75 years old. Most cases belonged to the age group of 11-20 years old constituted about 33.3% of all cases of traumatic cataract and the pediatric cases less than 18 years old constituted about 42.9% of all cases of traumatic cataract. Moreover, the age group ranged between 1 to

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30 years old included 695 patients, (83.5%). The majority of patients were male, 687 (82.6%), while 145 (17.4%) of them were female, with a male to female ratio was 4.7: 1. Out of a total 832 traumatic cataract patients, 259 (31.1%) were students, 246 (29.6%) were soldiers, and 104 (12.5%) were too young. The housewives represented 58 (7%) of all cases. Laborers and farmers accounted to 6.5% and 2.6%, respectively **Table (1)**.

Table (1) Demographic characteristics of patients performing traumatic cataract surgery.

Age distribution	n (%)
1-10 years old	203 (24.4)
11-20 years old	277 (33.3)
21-30 years old	215 (25.8)
31-40 years old	75 (9)
41-50 years old	34 (4.1)
51-60 years old	21 (2.5)
61 years old and above	7 (0.8)
Gender	
Male	687 (82.6)
Female	145 (17.4)
Occupation	
Student	259 (31.1)
Solider	246 (29.6)
None/Too young	104 (12.5)
Not recorded	69 (8.3)
Housewife	58 (7)
Laborer / Workman	54 (6.5)
Farmer	22 (2.6)
Others	20 (2.4)

Eye Injury Details

Regarding eye globe injury, open globe injury constituted nearly two thirds of cases (590 eyes, 70 %) and one third for closed globe injury (253 eyes, 30%). According to trauma etiology, most of the patients 283 (33.6%) were injured throughout warfare at combat zones, followed by domestic accidents 156 (18.5%), agricultural accidents 136 (16.1%), children accidentally injured while playing 102 (12.2%), other occupational accidents 63 (7.5%), assault accidents 41 (4.9%), adults accidentally injured while walking in the street 7 (0.7%), and road traffic accident 2 (0.2%). Most open globe injuries were of the penetrating type and involved cornea (corneal-scleral limbus) zone. The most common agents causing traumatic cataract in open globe injury were fragments secondary to explosion in 227 (38.4%) eyes, followed by wood objects in 139 (23.5%) eyes, while stones in 69 (27.4%) eyes and contusion effect of explosion in 56 (22.2%) eyes were the common traumatic agents in closed globe injury **Table (2)**.

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Table (2) Eye injury details among patients performing traumatic cataract surgery.

Variable	Open n = 590		Closed n= 253		Total n = 843	
Patient Location at Time of Injury	**N**	**(%)**	**n**	**(%)**	**n**	**(%)**
Combat Zone/ Battle Field	235	39.8	39	15.5	274	32.5
Home	110	18.6	57	22.6	167	19.8
Road	60	10.2	91	36.1	151	17.9
Farm	121	20.5	15	6	136	16.1
Work	45	7.6	17	6.7	62	7.4
Not recorded	20	3.4	33	13.1	53	6.3
Etiology of trauma	**N**	**(%)**	**n**	**(%)**	**n**	**(%)**
Warfare accidents	243	41.1	40	15.9	283	33.6
Domestic Accidents	98	16.6	58	23	156	18.5
Agricultural Accidents	121	20.5	15	6	136	16.1
Accidents while playing	33	5.6	69	27.4	102	12.2
Other Occupational Accidents	46	7.8	17	6.7	63	7.5
Not recorded	20	3.4	33	13.1	53	6.3
Assault	24	4.9	17	6.7	41	4.9
Accidents while walking	5	0.8	2	0.8	7	0.7
Road traffic accident	1	0.2	1	0.4	2	0.2
Agents causing ocular trauma	**N**	**(%)**	**n**	**(%)**	**n**	**(%)**
Secondary to explosion	227	38.4	56	22.2	283	33.6
Wood Objects	139	23.5	33	13.1	172	20.4
Stone	38	6.4	69	27.4	107	12.7
Metallic or steel objects	73	12.4	13	5.2	86	10.2
Undetermined blunt object	13	2.2	40	15.9	53	6.3
Gunshot (fragments/ bullet back)	46	7.8	2	0.8	48	5.7
Undetermined Sharp object	28	4.7	0	0	28	3.3
Not recorded	7	1.2	13	5.2	20	2.4
Glass Material	8	1.4	0	0	8	0.9
Body blow	2	0.3	6	2.4	8	0.9
Toys (Pistol beads, plastic toy, ball)	2	0.3	5	2	7	0.8
School supplies	5	0.9	0	0	5	0.6
Plastic material	0	0	6	2.4	6	0.7
Others	3	0.5	9	3.6	12	1.4

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Lens Injury Pattern and Associated Ocular Injuries

Preoperatively clinical findings regarding lens condition indicated that majority of traumatic cataract was observed in normal anatomical position with intact zonules in 775 eyes, (91.9%). Moreover, 51 (6%) eyes presented with subluxated lens, 12 (1.4%) eyes presented with dislocation, 3 eyes presented with anterior dislocation, 9 eyes presented with posterior dislocation, and 5 (0.6%) cases presented with intra-lenticular FB. Anterior capsule ruptured with lens matter in anterior chamber reported in 272 (32.3%) of the cases. Regarding ocular morbidities associated with traumatic cataracts, the most associated ocular damage was corneal injury in 491 (58.2%) cases, followed by posterior segment pathology in 359 (42.6%) eyes, and iris injury in 194 (23%) eyes of the cases. In addition, hyphema and raised IOP were recorded in 5.9% and 0.8% of the cases, respectively. Among the associated corneal damage, a full-thickness corneal laceration was present in 117 eyes and full-thickness corneal and scleral laceration was in 15 eyes; 132 eyes total. 178 (21.1%) eyes had a small self-sealed wound secondary to penetrating injury. Preoperative findings concerning iris included traumatic mydriasis in 8.1% of eyes, iris tears/iris dialysis in 6.5% of eyes, posterior synechiae in 5.5% of eyes, iris prolapse in 2.1% of eyes, and anterior synechiae in 1.07% of eyes. Posterior segment pathology included IOFB in 31.9% of the cases, vitreous hemorrhage in 28.6% of the cases, RD in 5.8% of the cases, and endophthalmitis in 3.4% of the cases. **Table (3)**

Table (3) Associated ocular morbidities among patients performing traumatic cataract surgery.

Associated ocular damage	NO
Orbital involvement (FB, fracture)	3
Laceration of lid margin	3
Corneal injuries	491
Corneal-scleral full thickness laceration	132
Sealed Corneal tear	178
Corneal partial thickness laceration	20
Corneal blunt trauma caused edema	6
Corneal wound sutured or scar	152
Corneal burn	3
Iris injuries	194
Sphincter damage/ traumatic mydriasis	68
Iris tears / Iris dialysis	55
Posterior synechia	46
Iris prolapse	18
Anterior synechiae	9
Hyphema	50
Glaucoma raised IOP	7
Posterior Segment pathology	359
IOFB	269
Vitreous hemorrhage	241
Endophthalmitis	29
RD	49

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Surgical Interventions and Complications

Primary surgical globe repair was performed firstly in 220 eyes, in which, 154 (18.3%) cases had surgery done outside and referred to our hospital for cataract extraction and 66 eyes had surgery done in our hospital firstly. 66 (7.8%) eyes had corneal rupture and repaired with cataract removal simultaneously. The majority of traumatic cataract, 518 (61.4%), had anterior surgical approach intervention, while posterior approach (PPLV) in 325 (38.6%) eyes had lens injury with posterior segment involvement which included vitreous hemorrhage, IOFB, endophthalmitis, posterior dislocation, and retinal detachment. As anterior approach, lens aspiration and irrigation were the main operation for traumatic cataract with 40.9%, followed by phacoemulsification in 18.6%, ICCE in 1.1%, and ECCE in 0.8% of eyes. Anterior vitrectomy was required in 146 (17.3%) eyes with ruptured posterior capsule and vitreous loss. Elective primary posterior capsulotomy with anterior vitrectomy was performed in 53 (6.3%) eyes. Patients' eyes were remained aphakia in 206 (24.4%) and IOL implantation was performed in 637 (75.6%) eyes, in which 541 (84.8%) eyes had primary IOL implantation and 97 (15.2%) eyes had IOL implant as secondary operation. The position of IOL mostly at the bag of posterior capsule in 567 (89.5%) eyes, followed by ACIOL in 43 (6.8%) eyes, 13 (2%) at sulcus, and secondary scleral fixation in 14 (2.2%) eyes **Table (4)**.

Table (4) Cataract surgery approach and pattern of IOL implantation among traumatic cataract patients.

Cataract Surgery Approach n = 843 (%)	
Anterior Approach	518 (61.4)
Lens Aspiration	345 (40.9)
Phacoemulsification	157 (18.6)
Intracapsular Cataract Extraction	9 (1.1)
Extracapsular Cataract Extraction	7 (0.8)
Posterior Approach (PPLV)	325 (38.6)
IOL implantation	n =638 (75.6)
Primary Operation	541 (84.8)
Secondary Operation	97 (15.2)
PCIOL	567 (89)
ACIOL	43 (6.8)
Sulcus IOL	13 (2)
Scleral Fixation	14 (2.2)

In terms of complications and secondary surgical interventions in the studies patients, it was found that posterior capsule ruptures (122 eyes, 14.5%) was the most common intraoperative complication either secondary to trauma or surgery. The most late postoperative complication was posterior capsule opacity (PCO) 70 (8.3%), followed by glaucoma 21 (2.5%), retinal detachment 19 (2.3%), phthisis bulbi 17 (2%), amblyopia 4 (0.5%), and endophthalmitis 3 (0.4%). Berlin's edema was discovered postoperatively in 9 eyes, while 5 eyes had macular scar and one patient had macular hole when edema cured. Further, postoperative findings of retinal comorbidity included macular scar in 25 eyes, macular

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hole in 2 cases, and traumatic optic neuropathy in 6 cases **Table (5).**

Table (5) Late postoperative complication among traumatic cataract patients.

Complications	Count (%)
PCO	70 (8.3)
Glaucoma	21 (2.5)
Retinal Detachment	19 (2.3)
Phthisis bulbi	17 (20)
Corneal complication (decompensation/ band keratopathy/ melting)	9 (1.1)
Amblyopia	4 (0.5)
Endophthalmitis	3(0.4)
IOL related complication	3(0.4)
Subluxated IOL	1(0.1)
Dislocated (drop) IOL	1(0.1)
Decompensated cornea secondary to AC IOL	1(0.1)
Cystoid macular edema	1 (0.1)
Hyphema	1 (0.1)
Traumatic hypotony	1(0.1)

The most secondary surgical operation was IOL implantation in 97 eyes, followed by 9 PPV + silicone operations for management 2 endophthalmitis and 7 retinal detachments. Nd-Yag capsulotomy was performed in 31 patients and surgical capsulotomy was performed for 7 children. Evisceration was done for 4 patients due to 2 eyes developed phthisis bulbi and 2 painful blind eyes (glaucoma secondary to silicone, melting cornea). One patient had severe cystoid macular edema which was detected postoperatively and intravitreal Avastin injection was given. One case developed intraocular lens displacement into vitreous due to inadequate support for intraocular lens and secondary scleral fixation was done. One patient had subluxated IOL and IOL corrected into sulcus. One patient developed corneal decompensation because of AC IOL and surgically IOL was removed. One patient developed hyphemia and AC wash was done.

Visual Acuity and Prognostic Factors

Pre-operative visual acuity was recorded in 795 patients while 48 5.7% of the patients could not be assessed because they were children less than 4 years. Majority of the patients, 713 (84.6%), had vision worse than (3/60) at presentation, in which counting fingers, hand movement, and perception of light were present in 142 (16.9%), 348 (41.3%), and 223 (26.6%) of cases respectively. The majority of patients achieved best corrected visual acuity at the end of follow-up better than (3/60) in 567 (67.3%) eyes, in which, 33.8% achieved ≥ 6/12, and 47% achieved ≥ 6/18. Postoperative monocular blindness, world Health organization <3/60, was represented in 228 (27%) eyes. **Table (6).**

Table (6) The Distribution of Postoperative final visual acuity among traumatic cataract patients.

Postoperative vision	Count (%)
≥ 6/18	396 (47)
6/24 to 3/60	171 (20.3)
< 3/60	228 (27)
can't assist	48 (5.7)

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Most patients presented with vision worse than 3/60 preoperatively achieved a best corrected visual acuity better or equal than 3/60 in 68.9% of the cases while the remaining patients maintained their vision less than 3/60 i.e., 31.1% monocular blindness. Only 6 patients whose vision preoperative was better than or equal to 3/60; loss their vision to less than 3/60 due to complications; 3 eyes retinal detachment, 2 eyes band keratopathy secondary to silicon and one eye developed glaucoma. Initial visual acuity was statistically significant factor for improving the final visual acuity ≥ 6/18, (χ= 20.399, p = <0.001). Other significant factors influence the final visual acuity ≥ 6/18 and causes of monocular blindness of 228 patients are shown in **Table (7)**.

Table (7): Factors affecting final visual acuity ≥ 6/18 and monocular blindness percentage among traumatic cataract patients.

Variable	Examined	≥ 6/18		< 6/18		OR (95% CI)	χ^2 Statistics [df]*	P value	< 3/60
		Number	%	Number	%				
Gender	Male	311	47.5	344	52.2	0.52 (0.39-0.84)	8.16 [1]	0.004	29.3
	Female	79	61.2	50	38.8				24.8
Age (years)	< 18	172	55.7	137	44.3	1.48 (1.11-1.97)	7.15 [1]	0.008	23.9
	≥ 18	218	45.9	257	54.1				31.6
Initial VA	≥ 3/60	64	78	18	22	4.10 (2.38-7.06)	29.42 [1]	<0.001	7.3
	< 3/60	331	46.4	382	53.6				31.1
Injury type	Open globe	259	46.3	301	53.8	0.63 (0.46-0.85)	8.94 [1]	0.003	31.6
	Closed globe	136	57.9	99	42.1				21.7
Anterior capsule rupture	Yes	144	57.8	105	42.2	1.61 (1.19-2.18)	9.62 [1]	0.002	24.9
	No	251	46	295	54				30.4
Posterior capsule rupture	Yes	34	30.4	78	69.6	0. 39 (0.25-0.59)	19.48 [1]	<0.001	45.5
	No	361	52.9	322	47.1				25.9
IOFB	Yes	89	33.1	180	66.9	0.36 (0.26-0.48)	44.82 [1]	<0.001	39.4
	No	306	58.2	220	41.8				23.2
Vitreous hemorrhage	Yes	66	27.7	172	72.3	0.27 (0.19-0.37)	65.495 [1]	<0.001	44.1
	No	329	59.1	228	40.9				22.1
Endophthalmitis	Yes	4	14.8	23	85.2	0.17 (0.06-0.49)	13.595 [1]	<0.001	59.3
	No	391	50.9	377	49.1				27.6
Retinal detachment	Yes	4	8.2	45	91.8	0.08 (0.03-0.23)	36.013[1]	<0.001	69.4
	No	391	52.4	355	47.6				26.0
Surgical Approach	Anterior	305	64.5	168	35.5	4.68 (3.44-6.37)	102.27 [1]	<0.001	17.3
	Posterior	90	28	232	72				45.3
Surgical procedure	One-step	23	36.5	40	63.5	1.15 (0.64-2.07)	0.217 [1]	0.64	44.4
	Two-step	69	33.3	138	66.7				37.7
Lens implant	Yes	369	62.9	224	37.1	18.6 (10.9-31.9)	173.15 [1]	<0.001	16.6
	No	16	8.3	176	91.7				66.7
Lens implant	Primary	333	65.4	176	34.6	2.02 (1.29-3.13)	9.90 [1]	0.002	15.1
	Secondary	46	48.4	49	51.6				25.3
IOL site	PCIOL	349	65.2	186	34.8	2.38 (1.43-3.96)	11.52 [1]	0.001	15
	Others	30	44.1	38	55.9				29.4
Corneal scar	Yes	97	32.7	200	67.3	0.33 (0.24-0.44)	54.98 [1]	<0.001	39.1
	No	298	59.8	200	40.2				22.5
PCO	Yes	47	73.4	17	26.6	3.04 (1.72-5.40)	15.71 [1]	<0.001	7.8
	No	348	47.6	383	52.4				30.5
Retina complication	Yes	3	3.5	83	96.5	0.29 (0.01-0.09)	82.32 [1]	<0.001	73.3
	No	392	55.3	317	44.7				23.3

Discussion

Vision is the most dominant of the five senses and plays a crucial role in every facet of our lives [5]. Traumatic cataract is an important cause of monocular blindness and contributes significantly to short-term and long-term vision impairment on the global scale. It is a result of mechanical or physical force that cause the crystalline lens position, stability, clarity, and capsular integrity to change. The main management of traumatic cataract is surgery as other types of cataracts, however, visual prognosis after traumatic cataract shows high unpredictability, and represents a huge challenge for ophthalmologists [3,7]. To the best of the researchers" knowledge, this is the first research about traumatic cataract in Yemen. This retrospective study was designed to report the incidence, clinical profile, and prognostic indicators for visual outcome in traumatic cataract surgeries. A striking result in this study is the highest incidence of traumatic cataract (0.78%), i.e. 7.8 patients per 1000 patients of eye OPD, in comparison to the results of previous studies which reported 6.9, 4.3, and 3 patients per 1000 patients of eye OPD [8-10]. On the other hand, this study showed that traumatic cataract represents 26% of sustained eye injury during study period, which is consistent with what has been found in previous studies [11-12]. In contrast, several studies reported lower incidence of traumatic cataracts than in the current study which ranged between 14.76% and 3.3% [2,10,14,15]. There is a difference in the literature concerning the incidence of traumatic cataracts.

In the present study, patients younger than 30 years old were the most affected with traumatic cataract (83.5%0; particularly in the age group (11-20) with 33.3% and 42.9% were children less than 18 years old, in addition to a noticeable male predominance (82.6%). Thus, male children and younger adults have been more frequently affected by traumatic cataract. Most researchers concerning demographic data about traumatic cataract reported similar findings [16-20]. This issue may be attributed to numerous reasons, as children are prone to such injuries due to low attention, inadequate risk assessment, and their significant activity at home and outdoor. For younger adult males, it can be attributed to their dangerous work pattern as soldiers, laborers, or farmers. Another reason contributes to sustain children with ocular trauma is the fact that 46% of the Yemeni population is under 15 years old according to 2021 estimates [21]. A study by Al-Shabooti and Bamashmus mentioned that children (≤16 years) constituted 61.1% of admitted and operated on eye injuries cases [22]. Aslami et al. reported that 50% of traumatic cataracts were less than 15 years while Dakshayani et al and Sofi et al. reported that 54-50% of them were in the age group below 20 years [23-25]. Hence, traumatic cataract secondary to ocular trauma is one of the main causes of visual loss in pediatric age group.

Our results demonstrated that about one third of the patients were students and 29.6% of them were soldiers. These results do not

concord well with previous studies wherein most suffering traumatic cataract were either students or farmers [18,26,27]. However, when comparing our results to previous studies, it must be pointed out that none of them mentioned included soldiers as a targeted group compared with civilian people.

Important evidence from this study is that open globe injury was the commonest injury pattern with fragments secondary to explosion and wooden objects; with thorns were the prevalent causative agents. On the other hand, one third of cases represented closed globe injury; with stones and contusion effect of explosion were the common traumatic agents. An addition, the most common circumstances of injury were throughout warfare at combat zones in 32.5% of cases, followed by domestic accidents at home in 19.8% and agricultural accidents in 16.1% of cases. Our results are supported by Viswanathan et al.'s findings regarding injury type as open-globe injuries (70%) vs closed-globe injuries (30%), and that trauma exposure at battlefield was the most serious risk environment (62%) [28]. Shah et al. also reported results similar to our study concerning injury pattern, however, wooden sticks and stones were the main causative agents of trauma and occurred while playing and home activity [29]. Li et al. documented that the number of eye injuries in Yemen had upward trends as a consequence of wars or conflicts over the past three decades [30].

The associated ocular tissue damage with traumatic cataract is considered a major risk for visual loss and a determining factor in decision making for traumatic cataract management. Our study showed that the majority of injuries are associated with 58.2% of corneal injury; in the forms of a full-thickness laceration (15.7%), a small self-sealed wound (21.1%), and corneal scar post-repaired (18%). These in turn obstruct the visual axis and impact visual prognosis. On the other hand, a striking finding in this study was the presence of posterior segment association (42.6%), in the forms of IOFB (31.9%), vitreous hemorrhage (28.6%), retinal detachment (5.9%), and endophthalmitis (3.4%). Furthermore, iris injury was the third common tissue accompany traumatic cataract, 23%. A similar pattern of results was obtained in a study conducted by Som et al. among small size sample of 50 patients, in which the main associated ocular tissue was 56% corneal injury, 44% posterior segment pathology, in decreasing order; vitreous hemorrhage, retinal detachment, and IOFB was commonly associated 28%, 14%, 2% and 38% uveal tissue injury [16]. Nadeem et al. and Mangane et al. demonstrated that 54% corneal injuries and injury to iris 28%, but they exclude posterior segment pathology in their studies [17,23]. There is a difference in the literature because of disparate methodology of traumatic cataracts concerning selecting sample, inclusion, and exclusion criteria. Another important element of preoperative evaluation of traumatic cataract should aim at determining the anterior and posterior capsule integrity. Hence, understanding the sequels of these is very important in surgical planning. In this study, it is interesting to note that anterior capsule ruptured with lens matter in anterior chamber was reported in 32.3% of the cases while posterior capsule rupture was reported in 14.5% of the cases that mostly

occurred in agricultural accidents and domestic accidents through thorn, tree branch, and sharp steel object. The presence of anterior capsule rupture is a significant indicator for presence posterior capsule rupture, 46.1% (χ^2 = 11.640, p value = < 0.001). Choudhury et al. showed that cataract with ruptured lens capsule and posterior capsular tear were found in 35.6% and 24.1% of cases respectively [10]. Dakshayani et al. demonstrated that 28% of cases had rupture of the anterior capsule and 14% of cases had posterior capsule rupture [24]. Memon et al. reported that anterior capsular rupture and pre-existing posterior capsular defects were observed in 44% and 14.6% of cases respectively [31]. Moreover, the status of lens has a role in decision the correct surgical approach. In this study, 6% of the cases presented with subluxated lens and 1.4% of them with dislocation; 3 cases anterior dislocation and 9 cases posterior dislocation. These findings are lower than the results found in the related literature that range between 17.2% to 7.5% [10,16,32,33].

Beside ocular comorbidity with traumatic cataract and obtaining accurate IOL measurement, surgical removal of lens poses considerably over complex than standard cataract surgery. Nevertheless, the main goal of management of traumatic cataract is to improve vision and prevent disability, the visual result and success rate usually reduce due to coexisting ocular damage either anterior or posterior segment pathology. Moreover, the choice of anterior or posterior surgical approach relies on surgeon experience and preoperative assessment. This study reported that several surgical interventions depend on the status of traumatic cataract and ocular tissue comorbidity. The majority of traumatic cataracts had anterior surgical approach intervention (61.4%) as lens aspiration was the main operation for traumatic cataract with 40.9%, followed by phacoemulsification in 18.6%, ICCE in 1.1%, and ECCE in 0.8% of cases. On the other hand, posterior approach (PPLV) was performed in 38.6% of cases for lens injury with posterior segment involvement that included vitreous hemorrhage, IOFB, endophthalmitis, posterior dislocation and retinal detachment. Anterior vitrectomy was required in 146 (17.3%) eyes, whereas elective primary posterior capsulotomy with anterior vitrectomy was performed in 53 (6.3%) eyes. Numerous valuable articles concerning traumatic cataract management are available. Nevertheless, there is a large discrepancy between our results and others' reports. This could be due to our large number of traumatic cataracts coexist with posterior segment pathology and different trauma circumstances in our study. For instance, Dakshayani et al. reported that anterior approach was accounted to 94% mainly via small incision with PCIOL and 6% by PPLV [24], whereas Shah et al. reported that lens aspiration underwent in 50.9%, lensectomy and vitrectomy in 19.1%, and delivery and vitrectomy in 31.7% [24-29]. Another study conducted by Ojeda et al reported that phacoemulsification/phacoaspiration was the main procedure in 96.25 %, followed by 2.5 % extracapsular cataract extraction, 1.25 % underwent intracapsular cataract extraction and automated anterior vitrectomy was done in 22.5 %. [32]. In contrast to our study,

Chuang et al. reported that 60% underwent PPLV and 40% lens aspiration or ECCE [34]. Intraocular lens implantation is a critical step in traumatic cataract surgery and important for vision rehabilitation, particularly in children to counteract the issue of amblyopia. Lens implant is either done as primary at the time of cataract removal or as a secondary implant during a second setting depending on intact of lens posterior capsule. This study revealed that intraocular lens was implanted in 75.6% of cases; with most of the cases (84.8%) performed as primary at the time of cataract removal and 24.4% were remained aphakia. A similar pattern of results was obtained in two studies carried out by Shah et al. and Akpolat et al., in which an intraocular lens was implanted in 77.27% to 81.6%, whereas 22.72% to 18.4% were left as aphakic, respectively [29-35]. For optimal vision rehabilitation, the position of IOL was mostly placed at the bag of posterior capsule in 89.5%, followed by ACIOL in 6.8%, 2% at sulcus and secondary scleral fixation in 2.2% of the cases. Ojeda et al. reported that in most of the patients, IOL was located in the capsular bag in 66.25%, in 25% it was located in the sulcus, 7.5% remained in aphakia, and in 1.25% IOL was implanted in a second procedure with iris fixation [32].

One of the causes that the eye remained aphakia was poor vision improvement due to massive coexisting trauma and postoperative complication as diffused central corneal opacity, retinal complications as macular scar or hole. In addition, 3 patients were age less than one years, 10 patients developed phthisis bulbi and 37 patients lost follow up. Unfortunately, keeping eye aphakia means some patients could be developing complication, as in this study 8 cases had glaucoma, 7 eyes had retinal detachment, and 6 eyes decompensated cornea (bullous keratopathy). Thus, primary IOL implantation is a key for prevention from these complications. Moisseiev et al. mentioned that a favorable vision outcome and a low rate of postoperative complication were associated with primary implantation of posterior chamber lenses after penetrating ocular trauma [36].

The most late postoperative complication was posterior capsule opacity (8.3%), followed by glaucoma (2.5%), retinal detachment (2.3%), Phthisis bulbi (2%), amblyopia (0.5%) and endophthalmitis (0.4%). Bekibele et al. reported posterior capsule opacity (12.5%), retinal detachment (9.4%), glaucoma (6.9%), and phthisis bulbi (3.1%), whereas Choudhury et al. reported posterior capsular opacification (9.2%), decentration of IOL (9.2%), and secondary Glaucoma (3.4%) [10,37].

From the data reported in this study, it is important to highlight the fact that a satisfactory visual outcome obtained after traumatic cataract removal and IOL implantation despite the coexisting troublesome ocular damage with lens injury. In our study, 67.3% of the eyes achieved a final VA of ≥ (3/60), in which, 33.8% achieved (≥ 6/12), and 47% (≥ 6/18). While 27% had poor vision less than < 3/60, i.e. blind in the injured eye. There is a wide agreement that excellent vision defined as 6/18 or better visual acuity after cataract surgery [8,29]. A similar pattern of our results was obtained in many others articles concerning the final visual acuity after traumatic cataract surgeries [23,29,38,39].

It is worth discussing the significant factors, as revealed in this study, that cause poor improvement in the final visual acuity in traumatic cataract patients ≥ 6/18 and lead to blindness in the injured eye < 3/60. One of the main reasons for poor visual recovery in this study was the initial visual acuity ≤ 1/60 which was statistically significant for non-improving the final visual acuity in 31.1% (χ^2= 20.399, p = <0.001) whereas initial visual acuity ≥ 3/60 was significant indicator for achieving ≥ 6/18 visual acuity postoperatively, (χ^2= 29.423, p = <0.001). Previous studies had similar results on initial visual acuity as predictive factor [16,26,27,29,40,41].

In our study, the percentage of blind eyes (< 3/60) with open globe injuries was 31.6%, more than closed globe injuries (21.7%), and there was a correlation between injury type and final visual acuity, (χ^2= 7.940, p = 0.005). Therefore, patients with closed globe injuries had satisfactory final visual acuity ≥ 6/18 in 58%, comparing to open globe injuries 46.3%, (χ^2= 8.944, p = 0.003). A similar pattern of results was obtained in many studies, though others have shown that open globe injuries had a more favorable prognosis for satisfactory > 20/60 visual recovery after management of traumatic cataracts [16,23,26,29,35,40]. Sofi et al. found that there was no significant difference in final visual outcome of traumatic cataracts caused by penetrating or blunt trauma (p = 0.73) [25]. The present study confirmed the findings of some previous researches that patients less than 18 years old gained significantly final visual acuity better than adults ≥ 18 years old, (x 2 = 7.146, P = 0.008) [7,8,25]. However, a study conducted by Som et al. suggested a favorable outcome in visual outcome was better in adult population as compared to pediatric population, where the difference was statistically insignificant. Özbilen et al. and Mangane et al. observed that there was no significant difference among adult and pediatric age group [16,39,40]. In spite of male predominance, female patients were significantly better than males according to final visual acuity, (x 2 = 8162, P = 0.004). Shah et al. and Özbilen et al. reported that there was no significant difference in visual outcome between males and females [7,40].

Other significant causes of no improvement in final visual acuity include presence of posterior segment pathology, in decreasing order: retinal detachment, endophthalmitis, vitreous hemorrhage, and IOFB, (p = <0.001). This is consistent with what has been found in previous studies [16,18,20,24,37, 41].

In addition, the unsuccess to gain good vision is attributed to the presence of posterior capsule rupture and remaining the eye without IOL implantation, (p = <0.001). Ojeda et al. mentioned that the presence of rupture posterior capsule increased the risk of vitreous prolapse with the possibility of more complications during and after surgery [32].

The results of our study disclosed that a clear support for obtaining favorable satisfactory final visual acuity is performing traumatic lens removal, with primary IOL implanted at capsular bag via anterior surgical producers mainly lens aspiration, lensectomy with primary posterior capsulotomy, phacoemulsification, and extracapsular cataract extraction, (χ^2= 9.900, p = 0.015 significant for primary IOL implantation) and (χ^2= 173.794, p = < 0.001) significant for

cataract surgery procedures. On the other hand, posterior cataract surgical approach via PPLV carried a poor visual acuity ≥ 6/18 in 28% and 45.3% had blind eye (< 3/60), (χ^2= 102.274, p = < 0.001) comparing with anterior surgical approach.

It is important to highlight the fact that different cataract removal procedures had different visual outcomes as well as different places of the IOL implantation [(26)]. IOL implanted in the capsule is the ideal position for vision and the success of visual rehabilitation in traumatic cataract cases without adequate capsular support depends upon the choice of the surgical procedure, the experience of the surgeon, and the preferred type of IOL [26,32,35]. Qi et al. documented that phacoemulsification had significantly better visual acuity than those with other procedures (x 2 = 92.3, P < 0.01) whereas Özbilen et al. and Rumelt et al reported no difference among surgical techniques [26,41,42]. Despite literature documentation is that IOL implantation is better done in a second session for visual prognosis, Yiğit et al. and Moisseiev reported that primary IOL implantation had good visual prognosis [8,20]. On the other hand, Singhal et al reported that IOL is the treatment of choice for improving vision and poor results associated with delayed surgery [36]. These findings support our results regarding the preference to implant IOL primarily during the extraction of the cataract than later in a secondary procedure (χ^2= 9.900, p = 0.015).

It is also notable that simultaneously primary repair of anatomical integrity of the globe and traumatic cataract removal is more prone to achieve poor vision than a two-step surgical procedure, however, a significant relationship was not found in this study (χ= 0.926, p = 0.336). This result is consistent with Yiğit et al [(20)]. In contrast, Özbilen et al. and Rumelt et al. obseved no difference between simultaneous and secondary surgeries (p = 0.413) and (p = 0. 0.32), respectively [40,42]. Finally, this study found that the presence of posterior segment complications and significant corneal scaring following ocular injuries were the main factors responsible for blind eyes (<3/60) in 72% and 39.1% respectively, (p = <0.001). Overall, these findings are in accordance with findings reported in some previous studies [27,31,37,43].

Conclusion

The present study revealed that nearly a one third of the patients sustained ocular injuries had traumatic cataract with the overwhelming predominance of male, age group (1- 30) years old, involving children particularly, open globe injuries and concurrent injury to the cornea. Traumatic cataract surgery is a highly successful procedure for achieving good visual acuity (≥6/18) in about half of the patients (47%). The foremost step in management traumatic cataract is identifying the prognostic factors that influence the final visual acuity via carefully preoperative examination to determine the suitable surgical technique and inform the patient the potential of visual outcome postoperatively. The study concludes several prognostic factors that could represent guidelines for ophthalmologists in traumatic cataract surgery. Young age, femininity, initial visual acuity ≥ 3/60, closed globe injuries, anterior surgical producers mainly lens aspiration, phacoemulsification, and ECCE with primary

IOL implanted in intact capsular bag were found favorable factors for achieving good visual acuity (≥6/18). On the contrary, adulthood, masculinity, initial visual acuity ≤ 1/60, open globe injuries, posterior segment involvement (retinal detachment, endophthalmitis, vitreous hemorrhage or IOFB), anterior or posterior capsule rupture, remaining the eye without IOL implantation, PPLV, and secondary IOL implantation were found statistically significant prognostic indicators for poor visual outcome after traumatic cataract surgery. Posterior segment complications and significant corneal scaring following ocular injuries were the main factor responsible for blind eyes (<3/60).

In sum, traumatic cataract remains a frequent sequel of ocular injuries with a high incidence rate among ophthalmic outpatients. It is also an important cause of monocular vision loss which highlights for establishing an effective preventive measure through increasing the awareness and encourage health education, as traumatic cataract is a major public health issue resulting in longstanding blindness if not treated properly.

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