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Eye Injuries Caused by Shotgun and Air-Rifles Treated at the University Eye Clinic in Belgrade 2000–2009

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SUMMARY

Introduction Eye injuries caused by shotgun buckshot or air-rifle bullets are not common but are very severe, causing blindness of the injured eye.

Objective By comparison of different parameters, to determine which of these two types of injuries have more serious final effect on vision.

Methods A retrospective comparative analysis of patients with shotgun and air-rifle injuries, treated in the period 2000-2009 at the University Eye Clinic in Belgrade was carried out, with patients being divided in two groups depending of the type of the weapon. Age of patients, occupation, days in the week and part of the day when the accidents happened, presence of the retained foreign body, as well as the visual acuity on admission and final visual outcome were reviewed and analyzed.

Results There were 16 shotgun and 5 air-rifle injuries. Mean age of patients injured by shotgun was 45.5±11.9 years, while those injured by air-rifle bullets were only 15.0±1.0 years old. Shotgun accidents happened in hunters, on weekends, in the morning, while air-rifle accidents were typical for pupils, on working days, in the afternoon. Final visual acuity following buckshot injuries was: NLP in 6 (37.5%), less than 0.1 in 6 (37.5%) and normal (1.0) in 4 (25%) patients. Out of patients hit by air-rifle bullet, no light perception (NLP) was documented in 4 (80%) while visual acuity remained normal in one patient.

Conclusion All injuries by shotgun and air-rifle are very serious, ending in loss of vision in high percent of cases. Prevention is essential.

Keywords: eye injuries; buckshot; air-rifle; visual acuity

INTRODUCTION

Eye injuries by shotgun are not common. They may be caused by gunpowder particles, when usually both eyes, the entire surface of the face and even other parts of the body are affected. Gunpowder particles may penetrate conjunctiva and cornea, and some of them may even penetrate into the eyeball [1, 2, 3]. However, eye injuries from a shotgun can be caused also by buckshot, accidentally during hunting. These injuries are more serious. Buckshot, due to its spherical shape, 5.6 mm caliber, 3.56 g of weight, with a speed up to 1250 m/sec, can penetrate through the eyelids into orbit and stay there or in the surrounding sinuses. Accordingly, the eyeball suffers due to contusion syndrome. A penetrating or perforating injury of the eyeball itself is possible, too [4-7]. Nowadays, eye injuries caused by air-rifles are very rare compared to the period of several decades ago when such accidents were far more common; they were usually very serious, and common reasons for enucleation of the eyeball [8-11]. Air-rifle bullet has a 5.52 mm caliber, 1.52 g of weight, and speed up to 200 m/sec. High number of serious accidents was the main reason for withdrawing air-rifles from free sale. Today, such injuries are the result of abuse of residual illegal weapons as toys. This study was aimed at determining similarities and differences of eye injuries caused by these two types of weapons, taking into account a variety of parameters.

OBJECTIVE

This study was aimed at determining similarities and differences of eye injuries caused by these two types of weapons in different settings.

METHODS

Patients with eye injuries caused by shotguns and air-rifles, hospitalized at the University Eye Clinic in Belgrade, Serbia, in the period from January 1st, 2000 to December 31st, 2009 were analyzed. All of them were hospitalized as emergency cases. All were examined by an ophthalmologist, their visual acuity was evaluated by Snellen charts, and all had a careful slit lamp and posterior segment examination. The same day, or at least the following day (as soon as possible), x-ray or CT scan was done to confirm or exclude the presence of any orbital foreign body. In the cases where x-ray was sufficient for detection and localization of the foreign body, CT scan was not performed. Dur-

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ing hospitalization, each patient was treated conservatively, and surgery was performed if required. Intraocular foreign bodies were removed by vitrectomy, while intraorbital ones were not removed. Once discharged, all patients were controlled after 15 days, two months and twice a year later on. There were no outpatients with such an injury.

For the purpose of the study, all patients were divided in two groups: the first group consisted of those injured by buckshot, while another group included people injured by the air-rifle bullet. Sex, age, place of residence, occupation, date and time of injury, nature of eye injury, presence or absence of foreign bodies and their localization were compared, and finally, visual acuity was checked once again.

The analysis of the cases included Fisher's exact test and t-test.

RESULTS

In 10-year period (2000–2009), 3,206 patients with mechanical eye injuries resulting from different causes were admitted and treated. Among them, there were 21 (0.7%) injured by bullet from a shotgun (16) or by air-rifle bullet (5). In all of them, just one eye was injured. Out of 16 cases with shotgun injury, the right eye was injured in 10 of them and the left one in the remaining 6, while in air-rifle injuries, the left eye was wounded in all 5 cases.

The patients were followed up for 24±6 months after hospital treatment.

In the group with shotgun injury, there were 10 contusions of the globe, 4 perforations and 2 penetrating wounds of the eye. In the second group with air-rifle injuries, there was 1 contusion, 2 penetrating and 2 perforating wounds of the eye.

Demographic characteristics and clinical data for individual patients were listed in Tables 1 and 2, respectively, while parametric values for these two groups were compared in Table 3.

DISCUSSION

At the University Eye Clinic in Belgrade, in 10-year period, 16 patients with a shotgun and 5 patients with an air-rifle injury were treated intrahospitally. A small number of air-rifle incidents is understandable, because this kind of weapon is prohibited by law to be used by children, and it is not available in the stores. Similar low incidence of eye injuries by this weapon is reported by other authors [8, 12, 13].

In the group injured by shotgun, out of 16 patients there was just one female, who was taking care of her cows at the time when she was hit accidentally by one of the hunters who did not notice her. All other 15 victims were hunters,

Table 1. Patients with eye injuries caused by buckshot

Patient	Sex	Age	Eye	Place of residence	Occupation	Day of injury	Hour of injury	Type of injury	Foreign body	Initial VA	Final VA
1	M	37	R	T	Ck	Mo	14.00	PN	IOFB	NLP	NLP
2	M	33	R	T	Ck	Su	12.30	CI	WFB	0.5	1.0
3	M	39	L	C	F	Su	09.00	PR	ORFB	NLP	NLP
4	M	44	L	C	W	Su	14.00	CI	ORFB	1.0	1.0
5	M	38	R	C	F	Su	07.30	PN	IOFB	NLP	NLP
6	M	54	R	T	Ck	Su	10.00	CI	ORFB	0.02	0.1
7	M	53	R	C	W	Su	07.30	CI	ORFB	LP	0.06
8	F	73	R	C	Hw	We	11.00	CI	ORFB	0.02	0.1
9	M	55	L	C	Ps	Su	10.30	PR	ORFB	NLP	NLP
10	M	57	L	C	F	Su	12.00	CI	ORFB	0.6	1.0
11	M	60	R	T	Ck	Su	10.30	CI	ORFB	0.02	0.1
12	M	36	R	C	W	Su	13.00	CI	ORFB	0.02	0.1
13	M	38	R	C	W	Sa	11.00	PR	ORFB	NLP	NLP
14	M	36	R	C	F	Su	13.00	PR	ORFB	NLP	NLP
15	M	29	L	C	F	We	14.00	CI	WFB	LP	0.06
16	M	47	L	C	W	Su	08.30	CI	WFB	0.7	1.0

M – male; F – female; R – right; L – left; T – town; C – country; Ck – clerk; F – farmer; W – worker; Hw – hauswife; Ps – pensioner; Mo – Monday; Su – Sunday; We – Wednesday; Sa – Saturday; PN – penetrating injury; PR – perforating injury; CI – contusion injury; IOFB – intraocular foreign body; ORFB – orbital foreign body; WFB – without foreign body; VA – visual acuity; NLP – no light perception; LP – light perception

Table 2. Patients with eye injuries caused by bullet from the air-rifle

Patient	Sex	Age	Eye	Place of residence	Occupation	Day of injury	Hour of injury	Type of injury	Foreign body	Initial VA	Final VA
1	M	14	L	T	P	Tu	16.00	PN	IOFB	NLP	NLP
2	M	15	L	T	P	Sa	16.00	PN	IOFB	NLP	NLP
3	M	14	L	C	P	Th	15.00	CI	ORFB	0.3	1.0
4	F	16	L	C	P	Sa	13.00	PR	ORFB	NLP	NLP
5	M	16	L	T	P	Th	14.00	PR	ORFB	NLP	NLP

P – pupil; Tu – Tuesday; Th – Thursday

Table 3. Some comparative parametric values of both groups of the injured

Parameter		Eye injuries		p value
		Buckshot (n=16)	Air rifle (n=5)	
Gender male		15	4	0.429
Age (years)		45.5±11.9	15.0±1.0	<0.001
Place of residence (town)		4	3	0.280
Type of injury	PN	2	2	
	CI	10	1	
	PR	4	2	
Foreign body		13	5	0.549
Visual acuity	≤0.1 – NLP	12	4	0.212
	1.0	4	1	

PN – penetrating injury; CI – contusion injury; PR – perforating injury; NLP – no light perception

having been hit by another hunter. Roden et al. [14] and Morris et al. [6] report males to be wounded, mainly in the hunt, and in some other sport activities, too (hunting, trap, skeet shooting, and sporting clays) [15]. In the other group with the air-rifle injuries, the majority was males, too: 4 boys and just one girl among 5 patients.

In both groups, all the injuries were unilateral. Other investigators confirm that injuries of this type are unilateral in most of the cases [13, 16, 17], but simultaneous bilateral wounds have been observed as well [12, 13, 15].

The mean age in the first group (shotgun) was 45.5±11.5 years and in the second one (air-rifles) it was only 15.0±1.0 years, so the difference is highly significant ($p<0.001$) (Table 3). Newman and Russo [12] and Schein et al. [17] report that the wounded by air-rifle were 13-15 year old adolescents. Occupation of persons hit by buckshot was as follows: 5 workers, 5 farmers, 4 employees, one retired person and one housewife, while all wounded by air-rifle were pupils (5 cases). It is worth mentioning that all accidents with shotguns in hunters occurred on weekends, in the morning (12 of them on Sunday). The explanation lies in the well known fact that group hunts are always organized on weekends, in the morning, while afternoons are reserved for lunch, socializing and exchange of recognized hunting stories. Pupils used to play with air-rifles in the afternoon on working days, when they were back from school, because the grownups were usually still busy or not at home at that time. In specific, no grownup was present at the time of accident in this group of pupils. In most cases, a schoolmate was the one handling the rifle; the only case when a girl was wounded was when her brother hit her. Schein et al. [17] report that, in the air-rifle incidents, a known person or a friend fired the weapon in 91% of cases and relatives in 40%, while grownups were not present in 11% of the time.

There were 3 kinds of buckshot injuries. Contusions of the eyeball were found in the majority of cases (10 out of 16, or 62.5%). In 7 of them, buckshot penetrated the eyelid, passed the eyeball and remained in the orbit. In all of these 10 patients with contusion of the eye, there was a significant chorioretinal damage, especially in the region of macula, with consecutive cicatrisation and corresponding impairment of visual acuity, i.e. 6 of them had final visual acuity of 0.1 or less. Perforation of the eyeball was found in 4 patients (25%). In all of them, buckshot passed through the eyeball and stayed in the orbit, resulting in the complete loss of function (NLP) in all 4 eyes. A penetrating injury was found in the remaining 2 patients (12.5%) with buckshot within the eyeball and final blindness (NLP) of the injured eye in both cases.

Altogether, patients hit by buckshot had final visual acuity as follows: NLP in 6 (37.5%), 0.1 or less in other 6 (37.5%), while vision remained normal (1.0) in 4 cases (25%) (Table 3).

Other investigators with similar number of patients injured by buckshot found similar percent of contusions, perforations and penetrations, with considerably poor functional outcome [13, 14, 15, 18].

In the air-rifle injured group, 2 patients experienced penetration with a bullet within the eyeball, another 2 had perforation with a bullet in the orbit, while the last one just had contusion of the eyeball with a bullet in the orbit. Final visual outcome was NLP in the first 4 cases, while the vision remained normal in the fifth one (contusion).

Similar percentage of contusions, penetrations and perforations in air-rifle eye injuries with poor visual outcome has been reported by other authors. In Schein et al. series [17], 84% of cases with penetrating injuries from the air-rifle had final visual acuity less than 0.1, while Shattleworth and Galloway [8] report complete loss of vision (NLP) in 53% of their cases with the air-rifle injury. Papers of Assaf et al. [16] and those of Newman and Russo [12] are worthy of note, the first stating that atrophy of the eye is common in the air-rifle injuries, while the second found enucleation as a common outcome. Marshall et al. [18] report that in persons younger than 18 years trauma is the reason for enucleation in 60% of cases, and in 25% of them an air-rifle being the weapon used.

It is obvious that, in both groups of the injured in our series, the complete loss of vision (NLP) was the final functional outcome whenever there was a perforating or a penetrating injury of the eye. Contusions were serious, but functional outcome was better in these cases.

It is significant that not one of the injured in our series had any protective glasses at the moment of accident. Some papers [19, 20, 21] emphasize the importance of wearing appropriate protective polycarbonate glasses for successful prevention of such injuries and effective protection of the eye.

CONCLUSION

It can be concluded that injuries caused by shotgun or air-rifle are mostly seen in males. Injuries caused by buckshot are typical for middle-aged men, on weekend days in the morning, while bullets from air-rifle hurt boys of about 15 years, on weekdays in the afternoon. Injuries caused by buckshot are mostly of contusion type, with better visual prognosis, while injuries by bullets from air-rifle usually cause penetrating or perforating injuries of the eyeball, which invariably ends up with complete loss of vision (NLP).

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REFERENCES

1. Kotagiri AK, Sundaram V, Khandvala M, Teimory M. Gunpowder injury to the eye. Clin Exp Ophthalmol. 2008; 36:190-1.
2. Amin K, Keenan J. Ocular gunpowder injury. Eye. 2007; 21:119-20.
3. Dreizen NG, Stulting RD. Ocular gunpowder injuries. Am J Ophthalmol. 1985; 100:852-3.
4. Bersudsky V, Kraus E, Rehany U. Unexpected intraocular ricochet path of shotgun pellet. Acta Ophthalmol Scand. 2000; 78:237-8.
5. Liu SY, Cheng WY, Lee HT, Shen CC. Endonasal transsphenoidal endoscopy-assisted removal of a shotgun pellet in the sphenoid sinus: a case report. Surg Neurol. 2008; 70 Suppl 1:S1:56-9.
6. Morris RE, Witherspoon CD, Feist RM, Byrne JB Jr, Ottemiller DE. Bilateral ocular shotgun injury. Am J Ophthalmol. 1987; 103:695-700.
7. Alfaro DV, Tran VT, Runyan T, Chong LP, Ryan SJ, Liggett PE. Vitrectomy for perforating eye injuries from shotgun pellets. Am J Ophthalmol. 1992; 114:81-5.
8. Shutteleworth GN, GallowayPH. Ocular air-gun injury: 19 cases. J R Soc Med. 2000; 94:396-9.
9. Endo S, Ishida N, Yamaguchi T. The BB gun is equivalent to the airsoft gun in the Japanese literature. Arch Ophthalmol. 2000; 118:732-3.
10. Sternberg P, de Juan E, Green WR, Hirst LW, Sommer A. Ocular BB injuries. Ophthalmology. 1984; 91:1269-77.
11. Harris W, Luterman A, Curreri PW. BB and pellet guns – toys or deadly weapons? J Trauma. 1983; 23:566-9.
12. Newman TL, Russo PA. Ocular sequele of BB injuries to the eye and surrounding adnexa. J Am Optom Assoc. 1998; 105:535-8.
13. Agbeja AM, Osuntokun O. Ocular gun-shot injuries in Abadan. Afr J Med Sci. 1991; 20:35-40.
14. Roden D, Cleary P, Eustace P. A five-year survey of ocular shotgun injuries in Ireland. Br J Ophthalmol. 1987; 71:449-53.
15. Warr WF, Cook RA. Shotgun eye injuries. Ocular risk and eye protection efficacy. Ophthalmology. 1992; 99:867-72.
16. Assaf E, Emadisson H, Bendeddouche K, Forestier F, Salvanet-Bouccara A. Pellet guns: a persistent threat to eye (Article in French). J Fr Ophthalmic. 2003; 26:960-6.
17. Schein OD, Enger C, Tielsch JM. The context and consequences of ocular injuries from air guns. Am J Ophthalmol. 1994; 117:501-6.
18. Marshall DH, Brownstein S, Addison DJ, Mackenzie SG, Jordan DR, Clarke WN. Air guns: the main cause of enucleation secondary to trauma in children and young adults in the greater Ottava area in 1974-93. Can J Ophthalmol. 1995; 30:187-92.
19. Ford JG, Barr CC. Penetrating pellet fragmentation. A complication of ocular shotgun injury. Arch Ophthalmol. 1990; 108:48-50.
20. John G, Feist RM, White MF, Witherspoon CD, Morris R, Kimble JA. Field evaluation of polycarbonate versus conventional safety glasses. South Med J. 1988; 81:1534-6.
21. Simmons ST, Krohel GB, Hay PB. Prevention of ocular gunshot injuries using polycarbonate lenses. Ophthalmology. 1984; 91:977-83

Повреде очију изазване ловачком и ваздушном пушком код особа лечених на Универзитетској очној клиници у Београду 2000–2009. године

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КРАТАК САДРЖАЈ

Увод Повреде сачмом из ловачке пушке и дијаболом из ваздушне пушке нису честе, али су веома тешке и често доводе до губитка вида на повређеном оку.

Циљ рада Циљ рада је био да се поређењем различитих параметара утврди која од ове две врсте повреда даје теже последице по функцију вида.

Методе рада Урађена је ретроспективна анализа болесника повређених сачмом из ловачке пушке и дијаболом из ваздушне пушке који су лечени на Клиници за очне болести Клиничког центра Србије у Београду од јануара 2000. до децембра 2009. године. Одвојено по групама, анализирани су старост и занимање испитаника, дани у недељи и време дана када су повреде настале, природа повреде очне јабучице (са постојањем страног тела или без њега) и видна оштрина.

Резултати Било је 16 особа повређених сачмом и пет повређених дијаболом. У обе групе налазила се само по једна повређена жена, остали испитаници били су мушкарци. Просечна старост испитаника повређених сачмом била је 45,5±11,9 година, а испитаника повређених дијаболом 15,0±1,0 година. Ловци су се повређивали углавном викендом (12 недељом) пре подне, док су се ученици повређивали радним данима у поподневним часовима. Код свих испитаника обе групе који су имали пенетрантну или перфоративну повреду очне јабучице дошло је до амаурозе. Код повређених с контузијом очне јабучице није забележена ниједна амауроза, али их је шест дијагностиковано код ловаца, чија је видна оштрина била мања од 0,1.

Закључак Повреде сачмом из ловачке пушке и дијаболом из ваздушне пушке су веома тешке по око и у великом броју случајева могу да проузрокују губитак вида. Превенција је посебно важна.

Кључне речи: повреде ока; ловачка пушка; ваздушна пушка; видна оштрина

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