Incidence, Distribution and Pattern of Firearm Injuries

DR.B.S.AHLUWALIA, M.D.,* DR.R.K.GOREA, M.D.,**

ABSTRACT

This study relates to a period of two years to find out the incidence of firearm injuries. Distribution of firearm injuries on the various body parts were studied alongwith their special features and cause of death. Findings of this study are given in the present paper.

Key Words: Firearm, Homicide, Suicide

Introduction

With the advent of firearm, injuries by it have been reported in the history books in the description of various wars in which these have been used. In the modern days use of firearms is increasing both by criminals as well as by law enforcing agencies. In the United States where these weapons are easily available, firearm injuries are amongst the leading causes of death(1). Its use is mostly homicidal (intended for this purpose) ,though people committing suicide sometimes use it (2) and rarely accidental injuries by firearm have been reported while cleaning the firearm or teaching how to fire, unsuspecting that weapon is loaded (3). Various authors have described the characteristics of firearm wounds e.g. lacerated wounds with inversion of margins, abraded collar and dirt collar at the entry wounds. Burning, blackening and tattooing may be present when the weapon is fired from a close range. The bullet or missile may pass through the body and cause exit wound with or without everted margins or may lodge inside the body depending upon the momentum of the missile (4,5,67). Pellets and wads usually remain in the body and do not cause exit wound (7) but large shot gun projectiles when fired from a sufficiently near distance may sometimes exhibit multiple exit wounds (8). We took the present study with a view to find out the incidence of above mentioned features and how we can help more the investigating agencies by correlating these physical aspects with the circumstantial evidence. Moreover no such study has been reported in the literature in our country in the recent past.

Material and Methods

This was a study done from the medicolegal injuries cases coming to the Casualty Wing of S.G.T.B.Hospital, Amritsar and postmortem cases brought to the mortuary complex, Medical College, Amritsar. This study was carried out during the first ten days of each month from 1.2.1985 to 10.1.1987. Data regarding age, sex and area was collected and physical aspects of firearm wounds were noted. Distribution of injuries on various body parts and internal organs were ascertained alongwith the cause of death.

Observations

1574 injury cases and 329 autopsy cases were studied (Total 1903) out of these, number of firearm cases were as follows:

	Percentage	Percentage
Autopsy	105	31.91
Injury	35	2.22
Total	**140**	**7.35**

* Professor and Head, * Lecturer, Department of Forensic Medicine, Medical College, Amritsar, Punjab - India.

Age and sexwise relationship with firearm injuries

Age group in years	Injury cases M	%	F	%	Autopsy cases M	%	F	%	Total Number	%age
0-10	-	-	-	-	1	0.95	2	1.90	3	2.14
11-20	1	2.85	-	-	7	6.66	1	0.95	9	6.42
21-30	15	42.85	1	2.85	50	47.61	1	0.95	67	47.85
31-40	10	28.57	1	2.85	18	17.14	1	0.95	30	21.42
41-50	4	11.42	1	2.85	17	16.19	-	-	22	15.71
51-60	2	5.71	-	-	6	5.71	-	-	8	5.71
61 & above	-	-	-	-	1	0.95	-	-	1	0.71
Total:	**32**	**91.40**	**3**	**8.55**	**100**	**95.21**	**5**	**4.75**	**140**	**99.96**

From this it is clear that 21-30 years period is the commonest age group which suffered fire-arm injuries (48.85%) and mainly the males were the victims (94.28%).

Areawise distribution of the cases were as follows:

Area	Injury cases Number	%	Autopsy cases Number	%	Total Number	%age
Rural	28	80	43	40.95	71	50.71
Urban	7	20	19	18.09	26	18.57
Border	-	-	43	40.95	43	30.71
Total :	**35**	**100**	**105**	**99.99**	**140**	**99.99**

Out of these cases incidence of firearm injuries is more in rural area.

Other injuries associated with firearm injuries

	Autopsy cases Number	%age	Injury cases Number	%age
Total Injuries	588		113	
Firearm injuries	526	89.45%	85	75.22%
Associated injuries	62	10.54%	28	24.77%

Distribution of the injuries on various parts of the body was as follows:

Body Part	Injury cases Number	%	Autopsy cases Number	%	Total Number	%age
Head	11	12.94	66	12.54	77	12.60
Neck	13	15.29	35	6.65	48	7.85
Thorax (front)	13	15.29	111	21.10	124	20.29
Thorax (back)	1	1.17	79	15.01	80	13.09
Abdomen (front)	5	5.88	45	8.55	50	8.18
Abdomen (back)	2	2.35	20	3.80	22	3.60
Upper limbs	21	24.70	103	19.58	124	20.29
Lower limbs	19	22.35	67	12.73	86	14.07
Total:	**85**	**99.97**	**526**	**99.96**	**611**	**99.97**

Maximum number of injuries were on the thorax 33.38%. Autopsy cases conformed to this distribution 36.11% whereas in injury cases upper limbs were the main targets 24.70%.

Distribution of injuries were compared in persons killed on border with others

Body parts	Border cases Number (43)	%age (40.95)	Others Number (62)	%age (59.04)
Head	7	2.91	59	20.63
Neck	14	5.83	21	7.34
Thorax (front)	46	19.16	65	22.72
Thorax (back)	41	17.08	38	13.28
Abdomen (front)	19	7.91	26	9.09
Abdomen (back)	15	6.25	5	1.74
Upper limbs	58	24.17	45	15.73
Lower limbs	40	16.66	27	9.44
Total:	**240**	**99.97**	**286**	**99.97**

Injuries on the head are less in border cases as compared to other cases whereas injuries on the limbs and back of abdomen are more in border cases as compared to other cases.

Physical aspects of the firearm injuries were as follows:

	Injury cases Number	%	Autopsy cases Number	%	Total Number	%age
Total No. of injuries	**85**	**100**	**526**	**100**	**611**	**100**
(lacerated wounds)						
Inversion	25	29.41	175	33.26	200	32.73
Eversion	12	14.11	96	18.25	108	17.67
Abraded collar	19	22.35	24	4.56	43	7.03
Burning	-	-	12	2.28	12	1.96
Blackening	3	3.52	23	4.37	26	4.25
Tattooing	-	-	15	2.85	15	2.45
Communicating injuries	-	-	438	83.26	438	71.68

So inversion and eversion of the margins of the wounds are the commonest observed of fire-arm injuries:

Foreign bodies seen radiological/recovered.

	Injury cases		Autopsy cases	
	Number of cases	%age	Number of cases	%age
Bullets recovered	-	-	25 (31 bullets)	23.80
Pellets recovered	-	-	6	5.71
Wads recovered	-	-	4	3.80
Radio-opaque shadows	9	25.71	-	-

Location of the injuries after dissection in autopsy cases

	Number	%age
HEAD & NECK		
Skull	29	27.61
Membranes	28	26.66
Brain	28	26.66
Vertebrae	4	3.80
Spinal cord	1	0.95
Larynx & trachea	5	4.76
Mouth & Oesophagus	2	1.90
THORAX		
Ribs fractured	49	46.66
Pleura	64	60.95
Right lung	50	47.61
Left lung	37	35.23
Heart	25	14.28
Large blood vessels	8	7.61
ABDOMEN		
Peritoneum	22	20.95
Stomach	7	6.66
Small intestine	12	11.42
Large intestine	12	11.42
Liver	17	16.19
Spleen	1	0.95
Kidney	8	7.61
Reproductive organs	1	0.95

Injuries to the lungs were maximum as compared to other organs.

Cause of death was as follows:

Direct	**No.**	**%**	**No.**	**%**
(i) Haemorrhage & Shock	**101**	**96.19 Remote**	**4**	**3.80**
(ii) Injury to brain	75	71.42		
	26	24.76		

Cause of death in most of the cases (96.19%) was from direct causes amongst which in 71.42% death occurred due to Haemorrhage & shock. In this study all the cases except one were homicidal in nature. One case was suicidal in nature.

Discussion

In this study incidence of death due to firearm injuries is as high as 31.91% probably this is due to factors of terrorist violence and the people killed while crossing the International border with Pakistan. While in Medicolegal injury cases this incidence is as low as 2.22% because most of the people suffering firearm injuries are not willing to give their consent for medicolegal examination out of the fear of terrorists. Deaths due to firearm injuries have been reported to be 25% (1). In this study most common group affected is 21-30 year (47.85%). This is due to the factor that persons crossing the international border mostly belong to this age group which got killed while crossing the border illegally.

Mainly the men are affected by the firearm injuries 94.28% as compared to females because personal enimity leading to death is the prerogative of males and persons crossing the border were exclusively males. (personal enemity including targets of terrorist violence).

People in the rural area suffered more firearm injuries as compared to urban area which may be due to the fact the terrorist activity was more in villages. Sometimes firearm injuries were associated with other injuries which included in our study abrasions and contusions which were due to falling after being hit by the bullet or missile. Sometimes the victim was simultaneously attacked by many weapons held by different attackers when associated injuries included abrasions, contusions,lacerated wounds and incised wounds. Associated injuries are reported to the extent of 9% (9) which corresponds to our study 10.54%.

Regarding distribution of injuries on the various parts of the body, in medicolegal injury cases mainly the upper extremities were involved 24.70% whereas in autopsy cases, involvement of thorax was maximum 33.38% (in the vital part and causing death).

Limb injuries were reported to be 55.5% in the study done by Samanta (1966) whereas in our study these were 34.36% because of a different situation of war in Samanta study in which the firing is at random and other projectiles like bombs shells splinters also cause injuries and due to similar reasons involvement of upper limbs was 42% (9) as compared to 20.29% in our study.

Presence of firearm injuries on head are reported to be 10% (10) , 12.7% (11) and are comparable to the findings of this study 12.6%.

When we compared the firearm injuries sustained by persons killed on the border with other cases we observed in border cases that wounds on the head were less (2.91%) as compared to 20.93% in other cases (specific target of the head was taken to shoot the victim to death). In border cases injuries were scattered on the body (Vital area 591.4%, Non vital area 40.83%) whereas in other cases injuries on the vital area 74.8% and on non vital area 25.17% indicating firing in the vital areas with minimum shots and minimum time to facilitate running away, whereas in border area the aim was either to injure & incapacitate the victims so that he cannot run away or to kill him.

As far as the physical aspects of firearm injuries are concerned all firearm injuries were lacerated wounds as also shown by the study of Spilsbury in 1925. We agree with Marshall (12) that some of the bullet wounds refuse to conform to the textbook description. All the exit wounds were larger than the entry wounds in our study. Inversion was the most characteristic feature at the entry wounds though it was not present in all the entry wounds so was the eversion at the exit wounds,again not prominent in all the exit wounds. Next feature of importance which helped in ascertaining the entry wounds was abraded collar. Though it was not present in all the entry wounds and this fact is also mentioned by Marshall (12). While in close range entry wounds we observed burning, blackening and tattooing on the skin which was not covered by clothes. Most of the injuries in this study were communicating (438 i.e.83.26%). The direction & track could be ascertained in almost all the cases from the

tissue damage which goes on increasing as the bullet goes on traversing the various body tissues from usually clotted blood is present along the track) except of a few cases which present complications due to ricochet-ing bullets or missiles inside the body where exhaustive dissection had to be done to locate the missiles or track. We recovered 31 bullets from 25 cases, pellets from 6 cases or track. We recovered 31 bullets from 25 cases, pellets from 6 cases and wads from 4 cases. All of which were sent to ballistic expert for identi-fication of the weapon. All these were re-sponsible for 475 injuries and rest of the inju-ries 51(9.69%) were the gutter wounds caused by firearm (History and circumstantial evi-dence). The skull was involved in 27.61% cases and in 3 cases we observed that skull disintegrated into multiple pieces (usually vault showed fracture into multiple pieces which were sometimes missing and portion of the brain was adherent to the base of the skull which also depicted multiple fractures). This type of bursting effect has also been re-ported by Spilsbury (1925).

In this study injury to the brain was pres-ent in 28 cases out of which injury to the brain was the cause of death in 26(92.85%). Injury to the right lung was to the extent of 47.61%. In this study there were 22 cases in which peritoneum was involved (20.95%) and if we take these cases only and see the involvement of small gut it is to the tune of 54.55% which are comparable to the involve-ment of small gut to the extent of 56% (13). These figures in the table indicate the need and number of specialists which should be available for tackling the emergency cases of firearm injuries to reduce the mortality. Cause of death in 71.42% cases was haemor-rhage and shock which indicates the line of treatment which should be adopted at the earliest to decrease the mortality in those cases in which the brain is not injured. In this series all the cases except one were homicidal in nature (History and circumstantial evi-dence). One was suicidal in nature. This is in consonance with the statement made by Mant that firearm suicides are not common in the United Kingdom and many police sur-geons may never have the opportunity to see more than one or two in a life time (7). The suicidal case in this series had an entry wound on the forehead in the midline and was in a near contact position (eye witness). Spilsbury has also recorded a case of suicide by firearm injury on the forehead(3). In case of homicide by firearm multiple injuries are more frequent than in suicides (3), observa-tions of our study confirm this view and we found 525 injuries in 104 cases of homicide. If an injury in vital area is associated with one in hand or arm it is a strong presumption of homicide and so is our view as we had 170 injuries on extremities in 104 cases along with firearm injuries in the vital areas.

Bibliography

1. Fatteh.A., and Troxler.D.: The gun and its victims - A study of 1024 firearm fatalities in North Carolina during 1970, North Carolina Medical Journal, 1971, 32:489.
2. Fatteh.A.: Homicidal gunshot wounds of mouth. J. Forensic Sci. Soc., 1972, 12 : 347.
3. Spilsbury Bernard.H: Wounds and other injuries in their Medicolegal aspect. Lancet, 1925, 422-425.
4. Modi.N.J.: Modi's Textbook of Medical jurisprudence and toxicology, 20th ed. N.M.Tripathi Pvt. Ltd. Bombay, 1977, 221-230.
5. Camps.E.Francis: Gradwohl's legal medicine, 3rd Ed. A.John Wright & Sons Ltd. Publications, Chicago, 1976, 210-213.
6. Parikh.C.K.: Parikh Textbook of Medical jurisprudence and Toxicology 4th ed., Medical Publication, Bombay, 1985, 280-288.
7. Mant.A.Keithe: Tayler's Principles and Practice of Jurispru-dence 13th Ed., Churchill Livingstone, Edinburgh, 1984, 245-247.
8. Matto.B.N., Wani.A.. and Asgakar: Maharashtra Police Journal, 1973 Jan. & July, pp. 14, 5.
9. Samanta.B.P.: War wounds of extremities. Indian Journal of Surgery, 1966, 28(11) 632.
10. Rana.R.S.: Penetrating craniocerebral injuries. Indian Journal of Surgery, 1966, 28(11) 676.
11. Ray.A.K.: War wounds of abdomen. Indian Journal of Surgery, 1966, 28(11) 659.
12. Marshall.T.K.: A pathologist experience of terrorist vio-lence. The Medicolegal Journal 1988 56(1): 18-33.
13. Goyle.K.B.: War wounds of extremities. Indian Journal of Surgery, 1966, 28(11) : 632.

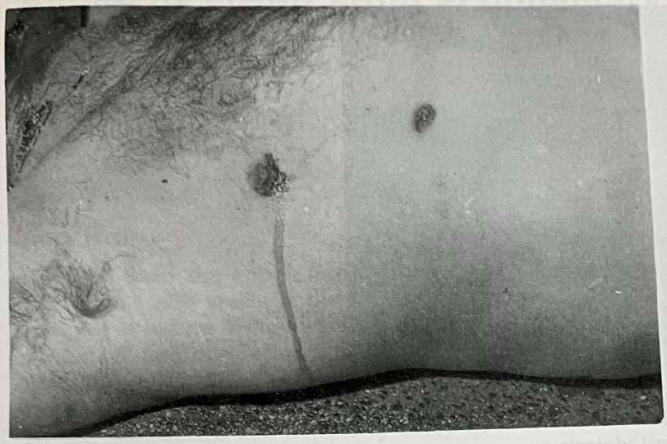
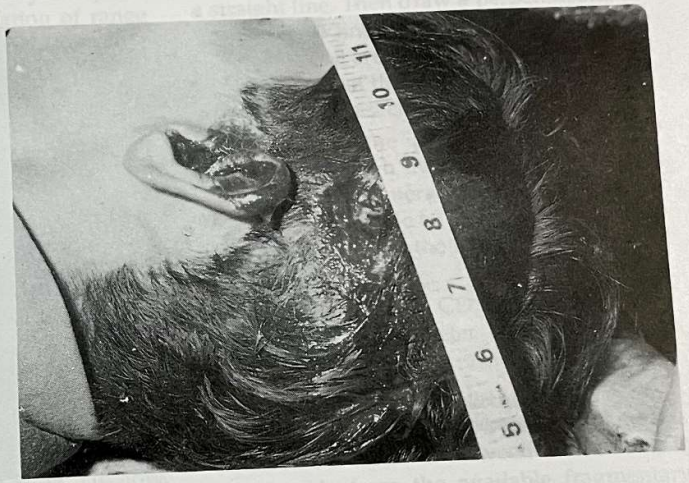


Fig.1. Entry Wounds Showing Abrasion Collar



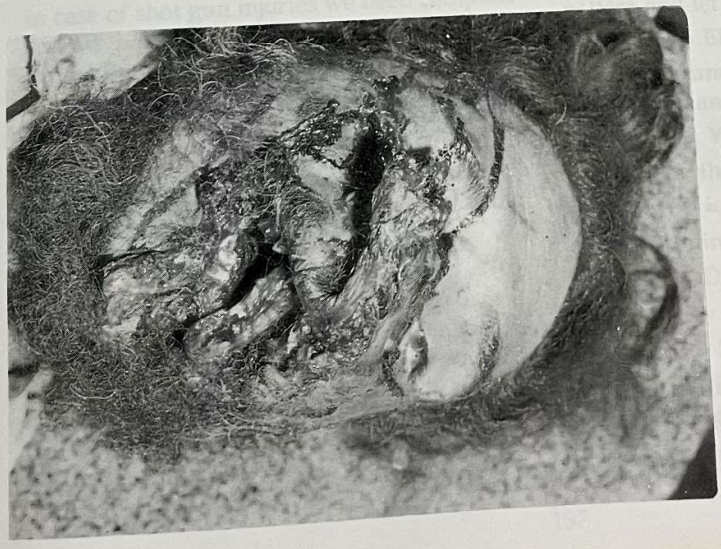


Fig.3. Exit wound on the Face showing Extensive Damage

Fig. 4. A Suicidal case showing entry wound with blackening and tattoing

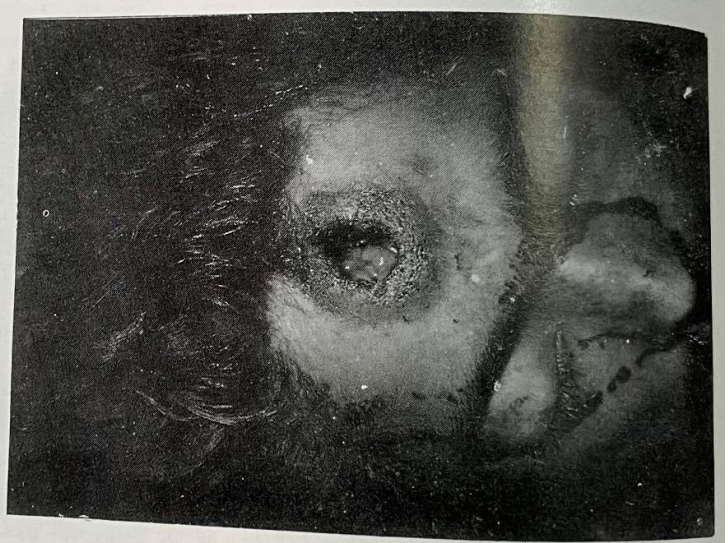


Fig.5. Suicidal case showing entry wound with tattoing (after Cleaning)