

Firearm Related Deaths in Lahore A Need for Efficient Emergency Services

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The present study was undertaken to know the areas of body most likely to be injured in firearm related deaths, the organs injured in such a situation, the survival time after these injuries and the cause of death in firearm related deaths. 240 deaths caused by firearm weapons were evaluated for the above purpose during a twelve-year period. It was found that an increasing number of people were dying of multiple shots and lesser and lesser number of people were able to reach the hospital following such an injury. The area of the body most frequently involved, in order of frequency was, the chest, the head and the abdomen in deaths due to single as well as multiple shots. The organs most frequently injured in multiple shot deaths were the lungs and major blood vessels. In deaths due to a single shot death was most often caused by injury to the solid organs (lungs, liver and kidney) followed by the brain, heart and major vessels in that order.

Key words: Firearm, organ injury

During the twelve years between 1984 and 1995, 4,25,235 deaths due to firearms occurred in U.S.A, an average of 35,436 deaths per year. 3,61,033 were male and 64,202 were female¹. Between June 1992 and May 1993, an estimated 57,500 non-fatal gunshot wounds were treated in hospital emergency departments in U.S.A². The ratio of fatal firearm related injuries to non-fatal injuries during 1992-93 were approx. 1:2.6³. There have been no extensive civilian studies to show the location of fatal gunshot wounds in the body in non-suicide cases⁴. A number of studies have been conducted involving combat casualties^{5,6,7}. One of the studies⁵ found that the head and neck constituting only 6.5% of the body surface accounted for 37.2% of fatal gunshot wounds. The thorax having 13% of the body surface comprised 36.4% of the fatal wounds and the abdomen, which constitutes 10.6% of the body surface, accounts for 9.2% of the fatal wounds. Di maio⁴, in his experience of civilian homicide cases has found that 40% of fatal gunshot wounds involve the brain, approx. 25% the heart; 25% the aorta or other main blood vessels and 10% the solid viscera-e.g. lungs, liver, kidney and so forth. A study on sites of fatal suicide wounds⁸ has shown 65.33% wounds occurring on the head, 21.66% on the chest, 6.66% on the abdomen and 6.33% on the neck. The lethality of a firearm related injury varies by intent. It has been reported that 90% of self inflicted gunshot wounds, 32% of assaultive injuries and 10% unintentional wounds by a firearm result in death⁹. Some other factors that affect the outcome of an injury include; the effectiveness of first aid management at the accident site¹⁰, the transit time between the site of injury and hospital and the effectiveness of treatment instituted in the hospital. In order to plan an improvement in the care of the severely injured patient, it is imperative to know what type of trained personnel and which particular facilities should be readily available. This in turn will depend on the nature and extent of injuries likely to present at the hospital emergency department. The present study is an attempt to

know the extent of injuries, areas and organs of the body involved, the period elapsed between injury and death and the cause of death in case of firearm injuries and to get an idea of what percentage of these deaths could be considered as preventable with improved health delivery systems.

Materials and methods

The surveillance data for the present study was taken from the 958 autopsies conducted by the authors between 1984 and 1995. 240 cases were selected where the cause of death resulted from an injury due to a firearm. The information obtained from autopsy reports, medico-legal certificates, operation and treatment notes and police papers was evaluated regarding the number of firearm injuries, area of body involved, organs injured, the time elapsing between injury and death and the cause of death in these cases.

Results

Firearm related deaths accounted for 25% of all autopsies conducted during the twelve-year period from 1984 to 1995. A five-fold increase in firearm related deaths was noticed in the period under study.

Table I Incidence of firearm related deaths in Lahore

Year	Total Autopsies	Cases of Firearms	%age
1984	87	8	9.19
1985	207	32	15.45
1986	190	49	25.78
1987	112	30	26.78
1988	65	12	18.46
1989	42	14	33.33
1990	28	12	42.85
1991	12	6	50
1992	116	38	32.75
1993	47	15	31.90
1994	30	13	43.30
1995	22	11	50
Total	958	240	25.05

Number of injuries

An increasing number of deaths are being witnessed as having been caused by multiple gunshots. Death was caused by a single shot in 50.83% of the cases and in 27.5% of the deaths more than two shots had been inflicted. The incidence of multiple shots has increased over the twelve year period being 18.75% and 14.28% in 1985 and 1986 respectively and rising to 38.46% and 45.45% in 1994 and 1995 respectively.

Table II Number of injuries

Year	Total	Number of Injuries				
		Single	Two	3-5	>5	Undeterminable
1984	8	6	1	1	0	0
1985	32	21	5	5	1	0
1986	49	26	16	6	1	0
1987	30	12	9	7	2	0
1988	12	7	0	4	0	1
1989	14	7	4	1	2	0
1990	12	5	0	3	4	0
1991	6	2	2	1	1	0
1992	38	20	5	5	6	2
1993	15	7	1	1	5	1
1994	13	6	1	2	3	1
1995	11	3	3	2	3	0
Total	240	122	47	38	28	5

Area of Body Involved

The area of body involved in firearm injuries was mainly the chest (58.75%) followed by the head (34.16%) and abdomen (30.83%) as shown in table III. In deaths due to a single discharge the thorax was hit in 41.80% of the cases followed by the Head and Neck (37.70%), Abdomen (17.21%) and Lower Limbs (3.27%) as shown in Table IV.

Table V Organ involvement in firearm related deaths

Year	Brain	S. Cord	Heart	Lungs	Liver	Spleen	Kidneys	Aorta	Vena Cava	Carotids	Jugulars	Other Vessels	Bones	Other Organs
1984	2	1	2	4	2	2	5	1	1	0	0	0	2	3
1985	12	3	5	16	2	4	1	4	3	2	1	2	19	12
1986	10	1	9	31	9	3	4	5	2	5	5	14	27	15
1987	10	1	4	15	9	3	4	2	1	1	0	4	13	15
1988	4	0	1	6	4	1	1	0	0	0	0	1	3	3
1989	3	2	3	8	3	0	0	2	0	2	2	3	3	3
1990	3	0	2	9	4	1	1	2	0	0	0	0	7	4
1991	1	0	2	4	1	1	0	1	1	0	0	0	1	2
1992	11	3	11	21	9	5	7	10	2	4	4	11	24	18
1993	3	3	4	8	5	3	2	2	0	0	0	1	8	8
1994	6	1	3	4	1	0	2	7	2	2	2	4	9	0
1995	4	1	3	9	5	1	1	4	1	0	0	3	0	5
Total	69	16	49	135	54	24	28	40	13	16	14	43	116	88

Table VI Organs injured in deaths due to a single shot

Total	Brain	Heart	Major Vessels	Solid Organs
122	40	19	21	42

Fatal Period of Victims

Fatal period is the period that elapses between the infliction of an injury and death. Out of the total of 240 cases studied, death occurred immediately in 71(29.58%) cases. Death took place within an hour in 91(37.91%) cases and took more than one hour in 73(30.41%) cases. A total of 78 cases died in hospital, which constitutes 32.5%

Table III Area of body involved in firearm related deaths

Year	Total	Head	Neck	Chest	Abdomen	Upper limbs	Lower Limbs
1984	8	2	0	5	3	1	0
1985	32	14	3	19	6	7	1
1986	49	14	6	29	9	11	13
1987	30	11	3	13	11	7	7
1988	12	4	1	6	6	1	2
1989	14	3	1	10	4	3	4
1990	12	3	0	8	6	7	4
1991	6	2	0	4	2	3	2
1992	38	11	5	24	14	9	3
1993	15	6	3	10	5	4	2
1994	13	7	2	4	6	5	6
1995	11	5	0	9	2	3	3
Total	240	82	24	141	74	61	47

Table IV Body area involved in solitary shots

Total	Head & Neck	Thorax	Abdomen	Limbs
122	46	51	21	04

Organs Injured in Firearm Injuries

The organs most frequently involved in firearm related deaths were the lungs (56.25%), the major blood vessels (52.50%) and bones (48.33%). The frequency of damage to other organs is shown in table V. In deaths due to a single shot, injury to the solid organs like lungs, liver and kidney caused death in 34.42% of cases and the brain, heart and major vessels caused death in 32.78%, 15.57% and 17.21% respectively as shown in Table VI.

of the cases, studied. The proportion of victims who reached hospital showed a steady decline during the period under study from 42.5% in 1984-85 to only 20.5% in 1993-95.

Cause of Death

Hemorrhage was the major cause of death accounting for 60.83%(146) of the cases, 26.66% died because of injury to the brain, 9.16% from septicemia and 3.33% from causes like pulmonary embolism and injury to the cervical cord.

Victims dying of septicemia constituted 28.20% of the total of 78 cases that died in hospital.

Table VII Survival time of victims

Year	Time between injury and death				Total
	Immediate	Upto 1 hr	>1hr	Un-determinable	
1984	2	3	3	0	8
1985	12	5	15	0	32
1986	17	16	15	1	49
1987	8	4	17	1	30
1988	4	3	4	1	12
1989	4	7	3	0	14
1990	3	5	4	0	12
1991	1	4	1	0	6
1992	10	22	6	0	38
1993	4	8	2	1	15
1994	4	8	0	1	13
1995	2	6	3	0	11
Total	71	91	73	5	240

Table VIII Cause of death in victims of firearm injury

Year	Cause of Death				Total
	Hgage	Brain injury	Septicemia	Others	
1984	6	1	0	1	8
1985	13	12	7	0	32
1986	35	8	6	0	49
1987	17	9	4	0	30
1988	6	4	1	1	12
1989	10	3	0	1	14
1990	6	3	1	2	12
1991	5	1	0	0	6
1992	27	10	1	0	38
1993	9	3	2	1	15
1994	6	6	0	1	13
1995	6	4	0	1	11
Total	146 (60.83%)	64 (26.66%)	22 (9.16%)	8 (3.33%)	240

Discussion

The incidence of firearm related deaths has increased tremendously over the period under study from only 9% of the total cases in 1984 to 50% of the total cases in 1995. This is similar to the figures given by the Punjab Police department in its annual crime reports¹¹ for the years 1984 to 1995 where the use of firearms has shown a four fold increase in Punjab in murders committed between 1984 to 1995. This is a more alarming increase than in U.S.A where a 130% increase in firearm related deaths has been reported over a 33 year period from 1962 to 1994¹².

During the period under study, the probability of multiple shots has increased from 18.75% in 1985 to 45.45% in 1995, reflecting the increasing use of automatic weapons which can discharge a large number of missiles in a short time.

In our study, the head and neck accounted for 44.16% of the injuries, the thorax was involved in 58.75% of the cases and abdomen in 30.83%. However in the 122(50.83%) cases of death by a single shot, 37.70% were on the head and neck region, 41.80% on the thorax and 17.21% were on the abdomen. Four out of the 122 cases (3.27%) were due to injuries to the lower limb alone

resulting in vascular injury in three cases. In one of the four cases, no major vessel of the lower limb was injured and death occurred in hospital due to septicemia. This is similar to the figures reported for combat casualties⁵ where the head and neck accounted for 37.2% of the fatal gunshot wounds, the thorax 36.4% and the abdomen was the area involved in 9.2% of the fatal cases. The difference is because of a different posture in combat situations where the abdomen is least exposed to a firearm discharge from the opposite side and therefore least susceptible.

We found that the brain was injured in 28.75% of the cases studied, the heart was involved in 20.41% the aorta and main blood vessels in 34.58% and the solid viscera like lungs, liver, kidneys and spleen in 90.41% of the cases. However in the 50.83% of deaths caused by a single shot, injury to the brain caused death in 32.78%, cardiac injury in 15.57%, the major blood vessels in 17.21% and damage to the solid viscera accounted for 34.42% of the deaths. This compares with the observations of Di Maio⁴, who in his experience of civilian homicides has reported 40% fatal gunshot wounds involving the brain, 25% each the heart and major blood vessels and only 10% the solid viscera. The higher percentage of deaths due to injury to solid viscera in our study is most likely to be due to a greater survival rate following similar injuries in the west due to efficient emergency medical services in the more developed countries. It is probably because of this reason that death following firearm injury to the limbs has not been reported in these studies in U.S.A.

For too long we have believed that anything done for the trauma patient is better than nothing. This is not true. Physicians do not undertake the care of a disease that they believe is outside their area of expertise. This specialization must also apply to treatment of the trauma patient.

It has been estimated that 5-10% lives may be saved and 50% of seriously injured patients may benefit from treatment at the accident site¹⁰. In a study on the effect of transit time on outcome for the patient, it was noted that out of the 100 patients of cardio-pulmonary arrest, those who died had an average pre hospital time of 43 minutes and those who survived had an average pre hospital time of 30.3 minutes; a difference of 12.7 minutes¹³. Organized and effective emergency services in Maryland U.S.A have decreased the number of deaths on admission after trauma by more than 50% compared with the rest of U.S.A¹⁴. A definite positive difference in survival rate has been reported where an organized trauma center exists¹⁵. The Maryland Institute for Emergency Medical Service System (MIEMSS) has reduced early statewide accident mortality by 23% despite increasing number of accident victims¹⁶. The care of the trauma patient in Maryland has been improved by the MIEMSS to an extent that during a five month period in 1983, out of 325 autopsies on deaths related to trauma, only three were questioned as being preventable¹⁶.

We must see increased training for those managing the pre hospital phase of patient care and the development of an integrated transportation system. Simultaneously we must categorize hospitals according to their ability to manage the patient. This includes staffing and support services capable of managing the most severely injured patient. If we can accomplish these goals, the care of the injured will improve.

The Medical community should lead in the design of systems to prevent trauma. Doctors should also lead in early identification of established systems which begin to fail, the implementation of protocols for pre hospital transport and care, the organization of hospital staff and resources to permit optimal care and the collection of data for trauma registries to facilitate epidemiological and clinical studies. The present study is a small step in this direction. There is a need to conduct similar studies on a much wider scale so that we may know what kind of injuries to expect in a hospital emergency department. This will help in being prepared to receive the critically injured patient with the right kind of trained personnel and adequate equipment to ensure increased survivability. What is also needed is better care at the trauma site and a need to improve the transit time, both of which are possible with organized Emergency Medical Services.

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