Original Article

TO STUDY THE CORRELATION BETWEEN STATURE AND PALM PRINTS AMONG NORTH INDIANS AND SOUTH INDIANS

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Abstract:

Forensic anthropology is an applied discipline. It is a branch of physical anthropology which interacts with other disciplines pertaining to understanding of crime and its investigation. Personal identification is an integral part of the crime investigation in cases of mass disaster where mutilated and disintegrated body parts are frequently found. Finger print and palm prints are available at most of crime scenes. In this study, efforts have been made to estimate the stature (height) of a person from palm prints. Palm prints were obtained from 160 individuals in the age group of 18 to 25 years. Their height is measured along with complete physical examination. All the above measurements were tabulated and subjected to statistical calculations and final results were further analyzed.

In the present study, regression formulae and multiplication factor has been derived to calculate stature from hand prints.

Key Words: Forensic anthropology, Stature, palm prints.

Introduction:

Forensic anthropology is the application of the anthropological knowledge and techniques in a legal context[1]. Forensic anthropologists while dealing with skeletol remains have very little choice to use anatomical method for stature reconstruction due to non availability of complete skeleton from crime scene in most of cases. Thus they have no choice but to use mathematical method which is workable even with a single long bone. Estimation of stature from skeletal material or from amputed and mutilated limb has significance in cases such as mass disaster, accident and murder.[2]

Estimation of stature from hand length has been reported from Saxena1984, Thakur and Rai 1987, Sharma and Kapoor 2001, Jasuja and G. Singh 2004, from hand length and breadth by Bhatnagar et al 1984, Rastogi et al 2008. [3]

In many crime scenes one can find latent prints including palm and fingerprint. Moreover in India, in every Government offices and most of the private sector companies, hand prints are obtained at the time of recruitment of employees. This definitely helps to identify the person who is missing and estimation of stature from these palm prints narrows the margin of error.

Previously Sharma and Kapoor 2001 and Jasuja and Singh 2004 have reported similar studies in North India.

India is a big country with varied geographic variations. Stature varies with geographical condition, race, environment and climatic conditions.[4] Considering all these facts, in present study attempt has been made to estimate stature of a person from palm prints. Also an attempt has been made to study relation of stature with palm print length and breadth in North Indians and South Indians separately.

Material and Method:

160 students of a medical college in Pondicherry aged 18 to 25 years were chosen for the study. Amongst them 40 were North Indian males and 40 were North Indian females.

Remaining 80 students comprised of 40 South Indian males and female respectively. Maximum height of a person is attained after the age of puberty, to be more precise at 18-21 years of age. For all practical purposes stature at 18 years of age is accepted as adult stature. The age above 18 year is chosen for the reason that by this age, there is completion of skeletal growth and ossification of all bones. Upper limit of age is taken as 25 years. Their consent was obtained, full particulars like name, age, sex and place to which they belong were recorded and their general and systemic examination was done. Permission was sought from the Institutional Ethical committee.

Following measurements were taken:

1. Stature (standing height): The subject was asked to stand barefoot on the base of a standard stadiometer in a standard standing position. The individual was instructed to stand with both feet in close contact with each other, trunk braced along the vertical board on the stadiometer with head oriented in ear-eye plane and the lateral palpebral commisure and the tip of the auricle of the pinna in a horizontal plane parallel to that of the feet. Then the measurement was taken in centimeters as the distance between the standing surface and highest point on the head (vertex) by bringing the sliding bar to the vertex.
2. Palm prints: Before taking the inked impression, subject's hands were thoroughly washed and allowed them to dry. The subjects were asked to place their hand prone on graph paper placed on table. Palm prints of both the hands are taken on the graph paper with hand fully relaxed with finger close to each other and thumb is apart. Palm print length is measured from midpoint of line joining the proximal maximum far points on print of wrist (corresponds to wrist crease) to tip of middle finger. Palm print breadth is measured as a distance between radial side of 2nd metacarpophalangeal joint to ulnar side of 5th metacarpophalangeal joint on the print on graph paper.[5]

All these measurements were taken by the candidate himself to avoid inter observer bias and recorded in the pretested and predesigned proforma. From which a master chart is prepared. All the above measurements were tabulated and subjected to statistical calculations and final results were further analyzed using SPSS (Statistical Package for Social Sciences, [12].)

Results:

Stature estimation in North Indian and South Indians is shown in table No.1

Table No.1: Comparison of stature between North Indian and south Indians

	Stature (cm)				
	Min	Max	Mean	SD	*P*
Males					
North Indians (n=40)	156	182	170.67	9.06	0.302
South Indians (n=40)	160	184	172.96	7.09	
Females					
North Indians (n=40)	137.8	175	157.77	8.44	0.752
South Indians (n=40)	147	167.5	172.86	5.22	

SD: standard deviation

In North Indian population, height is more in males as compare to that of females but in south Indian population, there is no significant difference. In this study south Indians are comparatively taller than north Indian in both sexes.

The mean value of hand dimension in both north and south Indian are shown in table 2 and 3 respectively.

Table No. 2: Hand dimensions in North Indians

Dimensions	Side	Male (n=40)					Female (n=40)				
		Min	Max	Mean	SD	*P*	Min	Max	Mean	SD	*P*
Hand Length	Right	15.9	20	17.78	1.14	0.917	14.4	17.8	16.02	0.91	0.670
	Left	16	19.8	17.81	1.06		14.4	17.9	16.12	0.95	
Hand Breadth	Right	6.8	8.9	7.58	0.49	0.896	6.0	7.6	6.88	0.40	0.528
	Left	6.7	8.7	7.56	0.48		6.3	7.6	6.94	0.32	

Palm Print length=Hand length, Palm print breadth=Hand breadth

Table No. 3: Hand dimensions in South Indians

Dimension	Side	Male (n=40)					Female (n=40)				
		Min	Max	Mean	SD	*P*	Min	Max	Mean	SD	*P*
Hand Length	Right	16.9	20.8	19.19	0.93	0.989	15.1	18.8	16.52	0.87	0.870
	Left	16.9	20.7	19.20	0.97		15.1	19.1	16.55	0.85	
Hand Breadth	Right	6.4	9.2	7.64	0.57	0.932	6.2	7.8	6.78	0.34	0.813
	Left	6.1	9.0	7.65	0.62		6	7.5	6.76	0.29	

Table No.4: Comparison of hand dimensions between North & South Indians

Dimensions	Side	Male			Female		
		North (n=40)	South (n=40)	*P*	North (n=40)	South (n=40)	*P*
Hand Length	Right	17.78	19.19	0.000	16.02	16.52	0.036
	Left	17.81	19.20	0.000	16.12	16.55	0.071
Hand Breadth	Right	7.58	7.64	0.668	6.88	6.78	0.327
	Left	7.56	7.65	0.534	6.94	6.76	0.032

In groups, hand length and hand breadth are larger in males as compared to that of females. Left hand length is comparatively and marginally larger in both North and South Indian population than right hand length. However difference is insignificant in breadth.

The linear regression equations are derived for estimation of stature in males and females in North Indian population shown in table no. 5 and 6 respectively.

Table No.5: Table showing Linear Regression Equation from both dimensions for height estimation in North Indian males

Dimensions	Side	Equation	Standard Error (SE)	Correlation coefficient (R)	Coefficient of determination (R2)
Hand Length	Right	S= 109.99+3.41(RHL)	1.35	0.429	0.184
	Left	S= 108.78+3.47(LHL)	1.46	0.408	0.166
Hand Breadth	Right	S= 105.56+8.64(RHB)	3.04	0.472	0.222
	Left	S= 117.41+7.04(LHB)	3.27	0.377	0.142

RHL=Right Hand Length, LHL=Left Hand Length, RHB=Right Hand Breadth, LHB= Left Hand Breadth

Table No.6: Table showing Linear Regression Equation from both dimensions for height estimation in North Indian Females

Dimensions	Side	Equation	Standard Error (SE)	Correlation coefficient (R)	Coefficient of determination (R2)
Hand Length	Right	S= 49.677+ 6.746(RHL)	1.186	0.732	0.5358
	Left	S= 49.752+ 6.698(LHL)	1.103	0.754	0.5685
Hand Breadth	Right	S=81.854+ 11.035(RHB)	3.339	0.530	0.2809
	Left	S=80.235+11.173(LHB)	4.480	0.426	0.1814

RHL=Right Hand Length, LHL=Left Hand Length, RHB=Right Hand Breadth, LHB= Left Hand Breadth

In both the sexes positive correlation coefficient shows relationship between hand length and hand breadth with stature. However in both sexes standard error is more in breadth as compared to that of length.

The linear regression equations are derived for estimation of stature in males and females in North Indian population shown in table no. 7 and 8 respectively.

Table No.7: Table showing Linear Regression Equation from both dimensions for height estimation in South Indian Males

Dimensions	Side	Equation	Standard Error (SE)	Correlation coefficient (R)	Coefficient of determination (R2)
Hand Length	Right	S=62.49+5.75(RHL)	0.928	0.76	0.577
	Left	S= 60.01+5.87(LHL)	0.80	0.81	0.656
Hand Breadth	Right	S= 142.67+3.95(RHB)	2.193	0.32	0.1024
	Left	S=136.32+4.77(LHB)	1.96	0.418	0.174

RHL=Right Hand Length, LHL=Left Hand Length, RHB=Right Hand Breadth, LHB= Left Hand Breadth

Table No. 8: Table showing Linear Regression Equation from both dimensions for height estimation in South Indian Females

Dimensions	Side	Equation	Standard Error (SE)	Correlation coefficient (R)	Coefficient of determination (R2)
Hand Length	Right	S=111.18+2.85(RHL)	0.992	0.478	0.228
	Left	S=104.625+3.26(LHL)	0.97	0.537	0.288
Hand Breadth	Right	S=143.57+2.17(RHB)	2.793	0.146	0.021
	Left	S=163.05-0.695(LHB)	3.28	0.04	0.0016

RHL=Right Hand Length, LHL=Left Hand Length, RHB=Right Hand Breadth, LHB= Left Hand Breadth

In both the sexes positive correlation coefficient shows relationship between hand length and hand breadth with stature. However in both sexes standard error is more in breadth as compared to that of length.

Multiple regression equations are derived to estimate the stature using various hand dimensions in north and south Indians.

Table No.9: Multiple regression equation for stature estimation

Population	Sex	Side	Equation	SEE	R
North Indian	Male	Right	98.174 + 1.413(RHL) +6.246(RHB)	6.520	0.487
		Left	97.513 + 2.433(LHL) + 3.940 (LHB)	5.761	0.443
	Female	Right	43.430 + 6.051(RHL) +2.527 (RHB)	4.979	0.738
		Left	42.442 + 6.404(LHL) + 1.736 (LHB)	5.100	0.756
South Indian	Male	Right	64.318 + 6.440(RHL) – 1.973(RHB)	2.944	0.772
		Left	59.609 + 6.724 (LHL) – 2.070 (LHB)	2.672	0.823
	Female	Right	101.445 + 2.8(RHL) + 1.570(RHB)	3.524	0.489
		Left	112.601 + 3.296 (LHL) – 1.305 (LHB)	3.806	0.542

Multiple regression equation shows better correlation coefficient than linear regression equations.

Multiplication factors were also calculated for hand dimensions in both the population.

Table No.10: Multiplication Factor in North Indian Population

		Male		Female	
Dimensions(cm)	Side	Multiplication Factor	Standard Deviation(cm)	Multiplication Factor	Standard Deviation(cm)
Hand Length	Right	9.62	0.61	10.35	2.67
	Left	9.6	0.59	10.23	2.36
Hand Breadth	Right	22.56	1.36	22.47	2.73
	Left	22.61	1.46	22.31	2.76

Table No.11: Multiplication Factor in South Indian Population

		Male		Female	
Dimensions(cm)	Side	Multiplication Factor	Standard Deviation(cm)	Multiplication Factor	Standard Deviation(cm)
Hand Length	Right	9.01	0.29	9.6	0.44
	Left	9.01	0.27	9.58	0.41
Hand Breadth	Right	22.71	1.63	23.39	1.34
	Left	22.69	1.66	23.45	1.33

In both the population standard deviation is more in case of hand breadth as compared to that of hand length.

Discussion:

The reviewed literature shows that certain factors like heredity, nutrition, climatic condition and races have influence over the stature. Considering this fact, in the present study an attempt has been made to find out stature from palm prints in North and South Indian populations.

In this study, in both groups males had greater hand dimensions and stature as compared to females which is similar to other studies.[5,6,7] This suggest that there is genetic difference between male and female and hence formula for one sex cannot be applied for other while estimating stature from palm print.

In present study, in both groups hand length is more on left side in both male and female though all subject selected in study were having right hand dominance. But similar difference is not found in case of hand breadth. So it does not show any significant relation between hand dimensions and dominance of hand.

Linear regression equation was derived to estimate stature from palm print length and breadth. The correlation coefficient ranges from 0.337 to 0.472 in North Indian males and 0.426 to 0.754 in North Indian females. Similarly in South Indian males it ranges from 0.32 to 0.81 and in South Indian females from 0.04 to 0.537. Hand length thus shows better correlation coefficient than hand breadth. Similar findings are observed in study done by Rastogi P et al.[4]

Multiple regression equation that has been derived using both hand length and breadth shows better correlation coefficient.

Multiplication factors were calculated with relatively higher standard deviation. But still it can be used for calculation of stature.

Conclusion:

In present study 160 students of medical college in Pondicherry aged 18 to 25 years were chosen. Among them 80 were North Indians and remaining were South Indians. Only students with right hand dominance were included though both hands palm prints were obtained .

No significant difference was found between hand dimension in north and south Indians.

No significant relationship between dominance of hand and hand dimensions was seen.

Regression equations are useful in estimating stature from palm print.

Multiple regression equation gives better results than linear regression equation.

Multiplication factors are also useful in determining stature from palm print.

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References:

1. Introduction to Forensic Anthropology; accessed through http;//www.forensicanthro.com on 2nd September 2009
2. Jasuja OP, Singh G .Estimation of stature from hand and phalangeal length.
3. Journal of Indian academy of Forensic Medicine 2004; 26(3):100-105
4. SharmaPK and Kapoor AK. Estimation of stature from finger tip length and finger print tip among criminals, Recent advances in forensic biology (edited),Kamla-Raj publishers 2001;pp 117-127
5. Rastogi P, Nagesh KR, Yoganarasimha k. Estimation of stature from hand dimensions of north and south Indians. Legal Medicine (2008);10:185-189.
6. Malek AKA, AhmedAFM, Aziz Sharkawi SAE, Abd Hamid NAEM EL. Prediction of stature from hand measurements. Forensic Sci.Int 1990; 46:181-7
7. Means LW, Walters RE. Sex handedness and symmetry of hand and foot length. Neuropsychologia 1982; 20:715-9
8. 7.Krishna K, Sharma A. Estimation of stature from dimensions of hands and feet in a north Indian population Forensic Leg Med 2007;14:327-32.

Original Article

A ROENTGENOGRAPHIC STUDY OF WRIST JOINT OSSIFICATION FOR AGE ESTIMATION IN THE MALE POPULATION OF CENTRAL INDIA

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Abstract:

In the living, age determination is the most important issue to the Courts and to the common citizens as well. Determination of the age of an individual from the appearance and the fusion of the ossification centers is a well-accepted fact in the field of Medical and Legal professions. Extensive work of determination of age from the epiphyseal union has been carried out abroad and in different states of India, which revealed the difference in the ages of epiphyseal union. The difference may be on account of varying sexual dimorphism, dietetic, geographic, hereditary and other factors keeping in mind that very less literature is available relevant to the population of this particular region of India. Present study is being undertaken for academic as well as in judicial interests.

This study was very much beneficial and yielding as it revealed age specific, bilateral difference of the ossification and remarkable difference in the age of ossification as compared to the foreign countries and other parts of India.

Key words: Age, Ossification centers, Wrist joint, roentgenographically, bilateral difference, less literature.

Introduction:

Forensic Osteology is a branch of Forensic Medicine which deals with the study of bones. Epiphyses of the bones unite during age periods which are remarkably constant for a particular epiphysis [1] which is helpful in age determination. In law the crime and punishment is entirely based on the criminal responsibility and this in turn depend on the age of a person [2]. According to Sangma William Bilkeych.et al age is helpful in identification of an individual which in turn is helpful in both civil and criminal cases [3]. It has been also stated that the study of epiphyseal union of bones is considered a reasonable scientific and accepted method for age determination by the law courts all over the world [4]. India is a vast country with diversity in social customs, multiple religions, dietary habits and variations in climatic conditions. Modi's textbook contends that owing to variation in climatic, dietetic, hereditary and other factors affecting the people of the different states of India, it cannot be reasonably expected to formulate a uniform standard for the determination of the age of the union of epiphyses for the whole of India [5]. According to Parikh CK, union of epiphysis in cartilaginous bones takes place earlier in the females by about 2 years than in males except in case of skull sutures where obliteration sets in little later and proceeds more slowly in females than in males and under tropical conditions ossification is observed earlier than in temperate areas [6]. According to Iscan M.Yasar and Loth Susan R (1984), estimation of age from the adult skeleton has been the most difficult part of Human identification studies. Human growth is continuous process which goes through first, a developmental stage and second, the maintenance of status quo. In the developmental stage, changes in skeletal and dental morphology occur in an age-age predictive sequence [7]. Reddy KSN stated that (2009) the bones of human skeleton develop from a number of ossification centers. At

eleventh to twelfth week of intrauterine life, there are 806 centers of ossification, at birth there are about 450. The adult human skeleton carries only 206 bones [8]. Mehta Homi S (1963) observed that it has been approved by research in our country that the epiphysio-diaphysial union in Indian occurs about a year or two in advance of the age at which that occurs in Europeans[9]. Jit and Balbir Singh revealed that the precocity of epiphyseal union has been attributed to racial and climatic factors. Works in different regions of India-North (Punjab, Delhi and UP), East (Bengal) and South (Madras) have given different ages of fusion of the epiphysis. Further, workers in the same region have also given different ages of fusion of the epiphysis of the same bone and in the same sex. This difference could possibly be due to inadequate material or recording of incorrect ages of the subjects [10].

It was therefore, decided to reinvestigate the problem in the central part of India by radiological examination, taking care that adequate material was examined and only those subjects were investigated whose ages were recorded with reasonable degree of accuracy.

Aims and Objectives:

Radiological evaluation of the bones forming the wrist joints (i.e. lower end of Radius, lower end of Ulna, Scaphoid, Lunate, Triquetral, Pisiform, Trapezium, Trapezoid, Capitate and Hamate) was undertaken with the following aims and objectives:

1) To estimate the age from ossification of bones of Wrist joint in relevant subjects belonging to indigenous population of the central India.
2) To assess the age specific difference in ossification of bones of Wrist joint in all the subjects.
3) To study the difference in the right and left side of ossification of bones of the Wrist joint in all subjects.
4) To assess and evaluate the difference in the ossification of bones of Wrist joint in central part of the India with other part of India on the basis of literature available.
5) To compare the deduced data with previously available data of other countries.

Material and Methods:

Total fifty four male individuals (54) were taken in this study from age ranging from zero to twenty years (0-20) from the period of November 2009 to October 2011 (2 year).

The individuals chosen for the study were evaluated and confirmed for the authentic proof of date of birth, physical fitness and their native place of central India. Individuals involved in study were predominately right handed. A written informed consent and permission from Ethical Committee of the our Institute was obtained.

Procedure of Radiography

After obtaining the written consent, a thorough physical examination and radiological evaluation was done. Training of researcher was undertaken to acquainted them with all the radiological procedures essential for X-Ray examination and developing X-Ray films. X-Rays were taken with the help of X-Ray machine in the Department. Joints involved in the study were subjected to minimum exposures and minimum and appropriate voltage settings of X-Ray machine were applied so as to avoid unnecessary radiation exposure of the subjects and to get the desired qualities of X-Rays. The developed X-Ray films were studied and reported by seeking assistance from an experienced Radiologist and Anatomist. All the radiological procedure was undertaken according to the present accepted standards. Skeletal maturity was evaluated according to the **Jits** and **Kulkarnis classification** of four stages,

Appearance, **Non fusion**, **Partial fusion**, **and Complete fusion** (abbreviated as **"AP", "NF", "PF", "CF"** respectively)[11].

Nonfusion: X-Rays showing clear gap between the epiphyseal and diaphysial end. The saw tooth like appearance ("NF")

Partial fusion: X-Rays showing a line replacing the hiatus between the epiphyseal and diaphysial ends and not showing saw tooth like appearance ("PF").

Complete fusion: X-Rays showing the same bony architecture in the diaphysis and epiphysis and showing scar of the previous stage have been treated as complete fusion ("CF").

The master chart was prepared and tabulated as per code number given above. It was classified, analysed and compared with known standards. Data analysis was done in P4 computer using HPSS software. At the end conclusions were drawn which are compared with available results of various previous studies.

Results:

X-rays showing gross bilateral difference of ossification of bones.

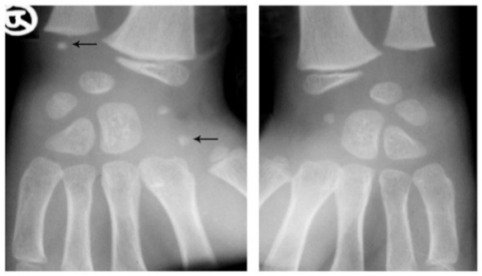

Photo 1 & 2: Lower end of ulna and Trapezium appeared only on the right side

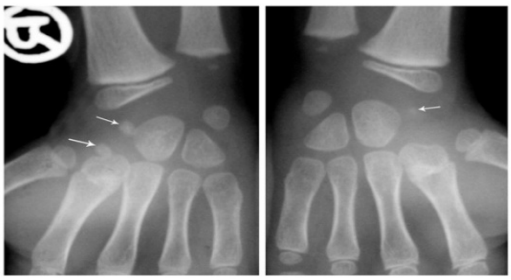

Photo 3 & 4: Trapezium appeared only on the right side. Scaphoid more prominent on the right side.

Table 1: Ossification of distal End of Radius on right and left side in the male subjects.

Age in years	Side	NA	NF	PF	CF	Total
<1-5	R	1(1.85%)	7(12.96%)	1(1.85%)	0(0%)	9(16.67%)
	L	1(1.85%)	7(12.96%)	1(1.85%)	0(0%)	9(16.67%)
6-10	R	1(1.85%)	4(7.41%)	12(22.22%)	0(0%)	17(31.48%)
	L	1(1.85%)	4(7.41%)	12(22.22%)	0(0%)	17(31.48%)
11-15	R	0(0%)	0(0%)	20(37.04%)	0(0%)	20(37.04%)
	L	0(0%)	0(0%)	20(37.04%)	0(0%)	20(37.04%)
16-20	R	0(0%)	2(3.70%)	0(0%)	6(11.11%)	8(14.81%)
	L	0(0%)	2(3.70%)	0(0%)	6(11.11%)	8(14.81%)
Total	R	2(3.70%)	13(24.07%)	33(61.11%)	6(11.11%)	54(100%)
	L	2(3.70%)	13(24.07%)	33(61.11%)	6(11.11%)	
ϰ2-value	R	25				
	L	25				
p-value	R	0.0003,Significant				
	L	0.0003,Significant				

Note: - Figures in parenthesis indicates percentage.

Distal End of Radius was appeared and non fused in 7(12.96%) subjects in <1-5 age group and completely fused subjects in 16-20 age group on both right and left sides.

Table 2: Ossification of distal end of Ulna on right and left side in the male subjects.

Age in years	Side	NA	NF	PF	CF	Total
<1-5	R	6(11.11%)	3(5.56%)	0(0%)	0(0%)	9(16.67%)
	L	5(9.26%)	4(7.41%)	0(0%)	0(0%)	9(16.67%)
6-10	R	9(16.67%)	5(9.26%)	3(5.56%)	0(0%)	17(31.48%)
	L	10(18.52%)	4(7.41%)	3(5.56%)	0(0%)	17(31.48%)
11-15	R	0(0%)	3(5.56%)	17(31.48%)	0(0%)	20(37.04%)
	L	0(0%)	3(5.56%)	17(31.48%)	0(0%)	20(37.04%)
16-20	R	0(0%)	0(0%)	3(5.56%)	5(9.26%)	8(14.81%)
	L	0(0%)	0(0%)	2(3.70%)	6(11.11%)	8(14.81%)
Total	R	15(27.78%)	11(20.37%)	23(42.59%)	5(9.26%)	54(100%)
	L	15(27.78%)	11(20.37%)	22(40.74%)	6(11.11%)	
ϰ2-value	R	63.45				
	L	71.23				
p-value	R	P<0.0001, Significant				
	L	P<0.0001, Significant				

Note: - Figures in parenthesis indicates percentage.

Distal End of Ulna has appeared and not fused in 3(5.56%) subjects in <1-5 age group and completely fused in 5(9.26%) subjects in 16-20 age group on right side and was appeared and not fused in 4(7.41%) subjects in <1-5 age group and completely fused in 6(11.11%) subjects in 16-20 age group on left side.

Table 3: Ossification of carpal bones on right and left Side in the male subjects.

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Age in years	Side	Scaphoid	Lunate	Triquetral	Pisiform	Trapezium	Trapezoid	Capitate	Hamate
<1-5	R	1(1.85)	2(3.70)	5(9.26)	0(0)	2(3.70)	0(0)	9(16.67)	9(16.67)
	L	1(1.85)	2(3.70)	4(7.41)	0(0)	2(3.70)	0(0)	9(16.67)	9(16.67)
6-10	R	13(24.07)	14(25.93)	17(31.48)	0(0)	11(20.37)	9(16.67)	17(31.48)	17(31.48)
	L	13(24.07)	14(25.93)	17(31.48)	0(0)	8(14.81)	8(14.81)	17(31.48)	17(31.48)
11-15	R	20(37.04)	20(37.04)	20(37.04)	11(20.37)	20(37.04)	20(37.04)	20(37.04)	20(37.04)
	L	20(37.04)	20(37.04)	20(37.04)	11(20.37)	20(37.04)	20(37.04)	20(37.04)	20(37.04)
16-20	R	8(14.81)	8(14.81)	8(14.81)	8(14.81)	8(14.81)	8(14.81)	8(14.81)	8(14.81)
	L	8(14.81)	8(14.81)	8(14.81)	8(14.81)	8(14.81)	8(14.81)	8(14.81)	8(14.81)
Total	R	42(77.78)	44(1.48)	50(92.59)	19(35.19)	41(75.93)	37(68.52)	54(100)	54(100)
	L								
ϰ2-value	R	34.14							
	L	35.82							
p-value	R	0.035, Significant							
	L	0.022, Significant							

Note: - Figures in parenthesis indicates percentage.

On right side Scaphoid, Lunate, Triquetral, Trapezium, Capitate, Hamate appeared in 1(1.85%), 2(3.70%), 5(9.26%), 2(3.70%), 9(16.67%), 9(16.67%) subjects respectively in <1-5 age group. Trapezoid appeared in 9(16.67%) in 6-10 age group. Pisiform appeared in 11(20.37%) subjects in 11-15 age groups. On left side Scaphoid, Lunate, Triquetral, Trapezium, Capitate, Hamate appeared in 1(1.85%), 2(3.70%), 4(7.41%), 2(3.70%), 9(16.67%), 9(16.67%) subjects respectively in <1-5 age group. Trapezoid appeared in 8(14.81%) in 6-10 age group. Pisiform appeared in 11(20.37%) subjects 11-15 age group.

Table 4: Comparison of the findings of the present study with the previous studies (in Yrs and months)

	Galstaun (Bengalis)	**Hepworth (IPunjabi)**	**NandyApurba**	**Pillai (Madrasis)**	**Flecker (Australians)**	**Davies & Parsons (Englanders)**	**Present study**
	year	year	year	year	year	year	Year
Distal end of radius							
Appearance	1					10-12 month	2-4
Fusion	16- 17	16 to 17		14 to 18	19	19 to 20	16-17
Distal end of ulna							
Appearance	10 - 11				6	7 to 8	4-7
Fusion	18			14 to 18	19	20	17-18
Triquetral							
Appearance	3 to 4		3		3	2 to 4	3
Lunate							
Appearance	3 to 4		4		4	3 to 4	4 - 6
Trapezium							
Appearance	4 to 7		4-5		5	6 to 7	4-6
Trapezoid							
Appearance	4to 7		4-5		6	7 to 8	4 to 7
Scaphoid							
Appearance	7 to 11		6		6	6 to 8	4-7
Pisiform							
Appearance	12 to 17		9-12	10 to 12	11	12	11-13
Capitate							
Appearance	½		1		1/2	3 to 5	1
Hamate							
Appearance	1 to 14 mon.		1		6 to 10m	4 to 5 mon.	1

Discussion:

Distal end of Radius:

In Bengali population the centre for distal end of Radius has appeared at 1 - 3 year earlier and Centre fused with the shaft of the Radius 0 - 1 year later on both right and left sides than in the present study[12]. In Englanders it is observed that the distal end of the Radius appears at 10-12 months and unites with the shaft of the Radius at the age of 19-20 year in males whereas in present study the centre for distal end of Radius has appeared at 14 months - 3 year later in some cases and has fused with the shaft of the Radius 3 – 4 year earlier on both right and left sides[13]. In a study on Punjabi Population it is revealed that the distal end of Radius unites with the shaft of the Radius at the age of 16-17 year in males which is correlating with the findings of present study[14]. In Australians population it is observed that in males the distal end of Radius unites with the shaft of the Radius at 19 years which is 2-3 years later than findings in the present study [15]. Lall and Natt in their study on males of Uttar pradesh found that the distal end of Radius fuses at the age of 19(20-21) year which is 3-4 year later than age of fusion appreciated in the present study [16].

Distal end of Ulna:

In a study on Bengali male population the appearance of the centre for distal end of Ulna was found at 10-11 year which is 4-6 year later and fusion at 18 year which is 0-1 year later than age of ossification in the present study [12]. In study on Englanders it is found that the distal end of Ulna appears at 7-8 year which is 1-3 year later and unites with the shaft of the Ulna at the age of 20 year which is 2-3 year later than age of ossification in present study[13]. In Australians population it was observed that in males the distal end of Ulna appears at 6 years which is 1 year earlier and 2 year later in some cases and unites with the shaft of the Ulna at the age of 19 year which is 1-2 year later than age of ossification in present study [15]. Lall and Natt in males of Uttarpradesh found that the distal end of Radius fuses at the age of 19 (20-21) years which is 2-3 year later than the age of fusion in present study [16].

Carpal bones:

In a study on Australians male population it is found that the **Scaphoid** has appeared at 6 year which is 2 year earlier and 1 year later in some cases in contrast to the present study [15]. According to Nandy A (2000) Scaphoid in males appears at 6 year which is 2 year earlier and 1 year later in some cases in contrast to the present study [17]. In Bengali male population it is found that **Lunate** appeared at 3-4 years which on comparison with the present study it has appeared 1 - 3 years later in males [12]. In study on Englanders it is found that the **Triquetral** appears at 2 - 4 years in males but in the present study it is found that the Triquetral has appeared 1 year earlier and 1 year later in some cases[13]. On observations in Australians population found that the appearance of **Pisiform** at 11 year in males, in contrast to this findings in present study it is found that it has appeared 0 - 2 year later on both right and left sides[15]. The age of appearance of Pisiform nearly correlates with Pillai M.J.S's (1936) study done in Madrasi population who found Pisiform appeared at 10-12 years of age in males [18]. In Bengali population it is found appearance of **Trapezium** at 4-7 years in males while on comparison with present study Trapezium appeared at 0-1 year later [9]. Nandy A (2000) found that Trapezium appears at 4-5 years in males which is 0-1 year later than findings in the present study [17]. Study on Australians population revealed that the appearance of **Trapezoid** at 5 year in males, on the contrary to this findings in present study

it is found that in males the Trapezoid has appeared 1 – 4 year earlier [12]. According to Nandy A (2000) Trapezoid appeared at 4-5 years in males while in the present study Trapezoid appeared 1-2 years later [17]. In Bengali population and in Australians population the appearance of **Capitate** is found at 6 months in males [12] [15], in comparison with these studies in the present study Capitate has appeared nearly 6 months later. In a study on Englanders it is found that the Capitate appears at 3 - 5 years in males, which is 2 - 4 year earlier than the findings of the present study[13].In a study on the Australians population the appearance of **Hamate** is found at 6 – 10 months in males, on contrary to this findings in present study it is found that the Hamate appears 2 – 6 months later in males [15]. According to Nandy A (2000) Hamate appears at 1st year in males which is correlating with the observation of present the study [17].

Summary and Conclusions:

1. This study was conducted exclusively on the young indigenous male population of Central India keeping in mind that very less literature about the age estimation from ossification of Wrist joint on both the right and left side is available involving this particular region of India.
2. The ossification at the Wrist joint in males on right and left side is completed in all instances at the age 17-18 year respectively.
3. The remarkable difference in the time of appearance of various ossification centers is observed on right side. Ossification was appreciated earlier on right side than left side in most of the cases. Contributing factors for this bilateral difference are not studied in this study, however right handedness in most of the subjects for earlier ossification on right side cannot be denied taking into consideration the available literature.
4. By comparing the available literature the age of skeletal maturity in males in this region is nearly similar to those in state of Punjab.
5. By comparing the available literature ossification center appear and fuse one to two years earlier in this study with population of Central India than those in Australia and England.
6. As this study is done in Central India region the application of standards of this study can be considered ideal for application in the region of Central India.
7. As the sample size is limited further studies are necessary. Region wise studies should be conducted for better correlation and comparison.
8. Due to changing life style pattern, dietary, climatic, behavioral factors age of ossification is changing as mentioned in the available literature. So as to evaluate these changes, studies are recommended in every region of India at regular time period for academic and judicial interest.
9. For correct age estimation in judicial cases X-rays of bilateral sides of the relevant joints for particular age should be taken to avoid miscalculation of age and miscarriage of the justice.
10. Along with the clinical and dental examination, radiological study plays an import role to arrive at the opinion about the age in medicolegal cases.
11. The opinion about age should be given always in the range. From this study it can be concluded that the opinion about age can be given in a range having margin of error of 1-2 years.

References:

1. Aggarwal A. Ages of ossification-Personal Identification in Self Assessment and Review of Forensic Medicine and Toxicology.1st ed.Delhi: Peepee Publishers and Distributers (P) Ltd.; 2006.p 51-59.
2. Srivastav A, Saraswat PK, Agarwal SK, Gupta P: A study of wrist ossification for age estimation in pediatric group in central Rajasthan. JIAFM. 2004; 26(4). *ISSN 0971-0973.*
3. Sangma WB, Marak F K, Singh M.S, Kharrubon B. Age determination in girls of north – eastern region of India JIAFM. 2007; 29(4):102-108. ISSN: 0971-0973.
4. Banerjee KK and Aggrwal BB: Estimation of age from epiphyseal union at the wrist and ankle joint in the capital city of India. Journal of Forensic science International. 1998; 98: 31-39.
5. Modi PJ. Personal identity – ossification of bones, in Modi's Medical Jurisprudence and Toxicology.22nd ed.edited by Subrahmanyam BV. New Delhi Butterworth's India; 1999. 52 – 58.
6. Parikh C.K. Personal Identity. Parikh's Text book of Medical Jurisprudence and Toxicology.6 th ed. CBS Publishers and distributers; 1996. 2.8-2.14.
7. Iscan MY and Loth SR. Estimation of age and determination of sex from the sternal rib. Forensic Osteology: Advances in the identification of human remains; 1984.68 – 89.
8. Reddy KSN. Identification-Growth in Individual bone, In the Essentials of Forensic Medicine and Toxicology. 29th ed. Hyderabad: K. Suguna Devi; 2009.64-71.
9. Mehta H.S. Age determination-Medical Law and Ethics in India. The Bombay Samachar Pvt. Ltd. Mumbai.1963;p.335-338 (cited in chapter Personal Identity in Modi's Medical Jurisprudence and Toxicology, 22nd ed. edited by Mathiharan K and Patnaik AK. New Delhi: Butterworth's India; 2005. p. 263 – 337).
10. Jit I and Singh. B.A radiological study of time of fusion of certain epiphysis in Punjabis. J Anat. Soc India. 1971; 20: 1 – 27.
11. Jit, I. Observations on prenatal ossification with special reference to the bones of the hand and foot. J. Anat. Soc. India. 1957; 6:12-23.
12. Galstaun G. A study of ossification as observed in Indian subject. Indian journal of Medical Research1937; 25(1):267-324.
13. Davies DA and ParsonsFG: The age order of the appearance and unionof the normal epiphyses as seen by X-rays. J. Anat. 1927, vol. 62:58-71.
14. Hepworth SM. Determination of age in Indians from study of the calcification of the long bones.Ind Med Gaz 1929; 64:128.
15. Flecker H. Time of appearance and fusion of ossification centers. Am J Roentgenol 1942; 47: 97–159.
16. Lall R and Nat BS. Ages of epiphyseal union at the elbow and wrist joint amongst Indians. Indian J. Med. Res 1934; XXI (4): 683-687.
17. Nandy A. Estimation of age from ossification activities of different bones, Study of ossification centres - Identification of an individual in Principles of Forensic Medicine including Toxicology.3rd ed.Kolkata: New Central Book Agency(P) Ltd.;2010.p 89-188.
18. Pillai MJS. The study of epiphyseal union for determining the age of south Indians. Indian J Med Res 1936; vol 23rd:1015-1017.

Original Article

LIGHTENING: A 15 YEAR STUDY OF FATAL CASES AT SVNGMC YAVATMAL

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Original Article

LIGHTENING: A 15 YEAR STUDY OF FATAL CASES AT SVNGMC YAVATMAL

Dr. SJ Gadge, Dr. MB Shrigiriwar

Abstract:

Lightning kills many people despite the fact that danger from lightning strikes is well recognized. It kills more people than other natural disasters such as floods and hurricanes. A review of the Indian medical literature shows paucity of published data regarding lightning fatalities. The Central India has a largely rural population, many of whom has low socioeconomic status and poor education, housing, and other infrastructure and hence (possibly) is at greater exposure risk. Forty seven victims of lightning-related death were identified from the records of Department of Forensic Medicine, Yavatmal, for period 1996 to 2010. Lightning strikes occurred from June to September (normal monsoon rainfall period), and most strikes took place in the afternoon. This study serves to illustrate the relatively high incidence of lightning strikes in the region and calls for a more systematic and detailed investigative protocol in lightning-related deaths.

Key words: Lightening, Burns, factors.

Introduction:

Lightening is defined as a momentary, atmospheric, transient, high current electric discharge whose path length is measured in kilometers from sky to earth. In lightening, very high voltages and amperages are involved and happen when highly charged thundercloud discharges via a huge arc to the ground. Most lightning discharges are within clouds, while some cause electrical discharge from a cloud to earth. Most human deaths are caused by cloud-to-earth lightning strikes.[1]

Lightning injury can occur in five ways: direct strike, orifice entry, contact, side flash, and blunt trauma. The primary cause of death in victims of lightning strike is cardiac arrest, which may be associated with primary ventricular failure or asystole. Lightning acts as an instantaneous, massive direct current shock, simultaneously depolarizing the entire myocardium. In many cases intrinsic cardiac automaticity may spontaneously restore organized cardiac activity and a perfusing rhythm. But concomitant respiratory arrest due to thoracic muscle spasm and suppression of the respiratory center may continue after return of spontaneous circulation. Unless ventilation is supported, a secondary hypoxic (asphyxial) cardiac arrest will develop.

Aims and Objectives:

This study is aimed at various conditions responsible for deaths due to electrocution brought to our tertiary care hospital.

The objectives of the study are:

1) To study the prevalence of lightening deaths at our hospital.
2) To ascertain the various conditions associated with deaths due to lightening.

Material and Methods:

The present study was carried out from January 1996 to December 2010 in the Department of Forensic Medicine & Toxicology at a Govt. Medical College and hospital,

Yavatmal. A standardized proforma specially designed for this purpose was used and filled in each case after detailed examination of inquest, autopsy, hospital records etc. to gather information.

Results:

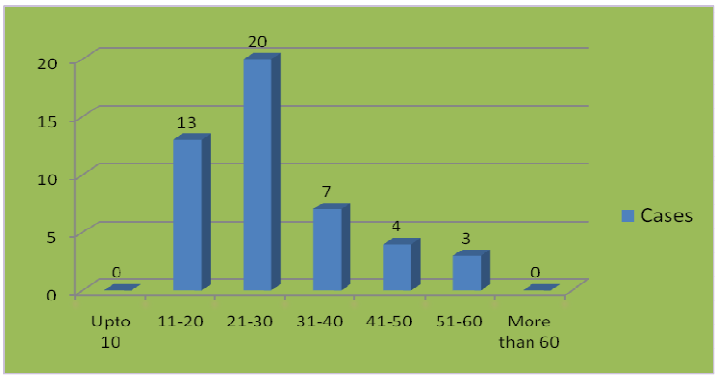

Figure no. 1: Distribution of study cases according to age of the victims

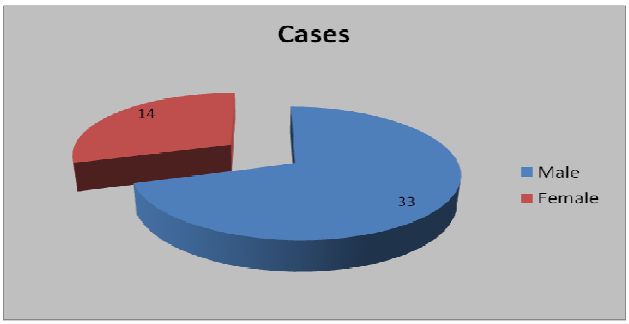

Figure no. 2: Distribution of study cases according to sex of the victims

Marital status	Cases	Percentage
Married	28	59.57
Unmarried	19	40.43
Total	47	100

Table no. 1: Distribution of study cases according to marital status of the victims

Occupation	Cases	Percentage
Farmer	23	48.94
Labourer	16	34.04
Students	7	14.89
Technician	1	2.13
Proffessional	0	0
Total	47	100

Table no. 2: Distribution of study cases according to occupation of the victims

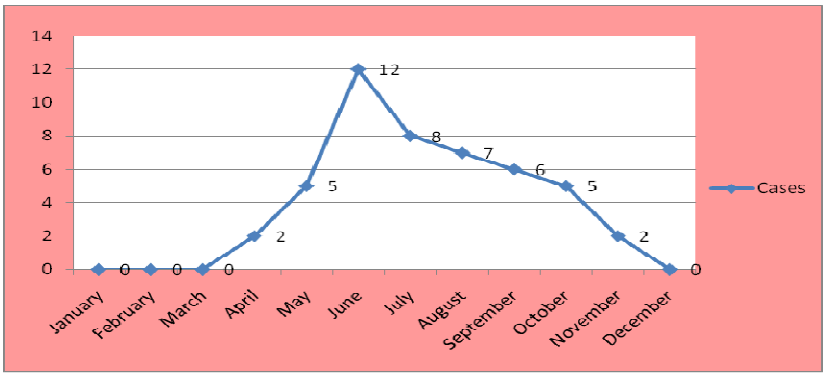

Figure no. 3: Distribution of study cases according to month of the incidence

Survival period	Cases	Percentage
Brought dead	38	80.85
Less than 1 hour	2	4.26
1 hour to 1 day	2	4.26
More than 1 day	5	10.63
Total	47	100

Table no. 3: Distribution of study cases according to survival period of the victims

Day	Cases	Percentage
Monday	06	12.77
Tuesday	05	10.64
Wednesday	08	17.02
Thursday	06	12.77
Friday	04	06.51
Saturday	10	21.27
Sunday	08	17.02

Table no. 4: Distribution of study cases according to days in week

Time of incidence	Cases	Percentage
0001 - 0600	07	14.89
0601 - 1200	06	12.77
1201 - 1800	18	38.30
1801 - 2400	16	34.04

Table no. 5: Distribution of study cases according to time of the incidence

Autopsy findings	Present	Percentage
Burns over the body	38	80.85
Magnetisation of metals	14	29.79
Singed hairs	20	42.55
Associated injuries	35	74.47

Table no. 6: Distribution of study cases according to autopsy findings

Cause of death	Cases	Percentage
Cardio-respiratory arrest	38	80.85
Burns	5	10.65
Head injury	2	4.25
Pulmonary infarction	2	4.25
Total	47	100

Table no. 7: Distribution of study cases according to cause of death

Discussion:

In present study maximum number of cases 20 (42.55%) were from 21-30 years age group, followed by 13 cases (27.66%) in 11-20 years and no cases at both the extremities. The minimum age of the victim was 13 years and the maximum was 60 years with average age 32.3 ± 17.5. Similar results were noted by Aslar AK et al (2001)[2], Dokov William (2009)[3]. This is due to the fact that children and adults are involved in outdoor activities in spite of bad weather. Findings of our study differ from Murthy OP et al (2009)[4], Bluementhal R (2005)[5], Wetli CV (1996)[6] and Philippe J Duclos and Lee M Sanderson (1990)[7].

In our study 33 cases (70.21%) were of males whereas female amounted to 14 (29.79%) and ratio of male to female was 2.33:1. Consistent findings were reported by Murthy OP et al (2009)[4], Dokov William (2009)[3], Sophie Pointer and James Harrison (2007)[8], Brian Mills et al (2006)[9], Aslar AK et al (2001)[2], Wetli CV (1996)[6] and Philippe J Duclos and Lee M Sanderson (1990)[7]. Males are involved in occupations which are mostly outdoor and hence more prone for lightening.

We observed that in 28 cases (59.57%) the victims were married and 19 (40.43%) were unmarried. Murthy OP et al (2009)[4] also reported similar results. This might be due to distribution of cases more in age group more than 21 years.

We found maximum cases i.e. 23 cases (48.94%) were farmers followed by 16 (34.04%) labourer and 7 (14.89%) students. Findings of Murthy OP et al (2009)[4] and Wetli CV (1996)[6] differ from our study. This might be due to most common outdoor activity carried in our region is farming and they lack proper place to hide during lightening.

Maximum cases i.e. 38 (80.85%) were brought dead and did not receive the treatment followed by 5 case (10.63%) who died after 1 day and mean survival period was 10.00 ± 23.83 hours. Murty OP et al (2009)[4], Bluementhal R (2005)[5], Philippe J Duclos and Lee M Sanderson (1990)[7] also noted similar findings. Aslar AK et al (2001)[2] found that the mean duration of hospitalization was short (17.3 days) and ranged from 1 to 62 days. The reason for this might be that after lightening, ventricular arrhythmias are most common effect on the body and this is life threatening condition and needs immediate treatment by skilled person.

In present study maximum cases of lightening i.e. 12 (25.53%) were seen during the month of June, followed by July 08 cases (17.02%), and 7 during August. Also maximum cases i.e. 33 (70.21%) occurred during June to September months which is the rainy season in our region. Similar results were noted by Dokov William (2009)[3] and Brian Mills et al (2006)[9]. Bluementhal R (2005)[5] also reported most cases during rainfall season. The most probable reason might be more number of lightening during this period resulting into more number of cases.

We found that most cases i.e. 10 (21.27) on Saturday followed by 08 (17.02) each on Sunday and Wednesday. Brian Mills et al (2006)[9] found most cases during Saturday (26.4%) and Curran et al (2000)[10] also reported most cases during Sunday followed by Wednesday. The most probable reason is that people indulge in more outdoor activities on weekends and holidays.

In our study most of the cases i.e.18 (38.30) occurred during 1201 to 1800 hours. Bluementhal R (2005)[5], Curran et al. (2000)[10], Wetli CV (1996)[6] and Philippe J Duclos and Lee M Sanderson (1990)[7] also noted consistent findings. This is the time for most of the people to finish their daily work and go back to respective home, hence more susceptible to strike by lightning.

We found burns over body in 38 cases (80.85%). Findings of our study are consistent with that of Bluementhal R (2005)[5] and Wetli CV (1996)[6]. Blumenthal R (2006)[11] discussed

metal objects may burn the underlying skin, or mark the skin due to heat of electrical arcing. Also unique arborescent or fern-like injuries (Lichtenburg figures) should be noted. This is due to high voltage of direct current in lightening.

Magnetization of the metal worn was noted in 14 (29.79%) cases. Wetli CV (1996)[6] also found magnetization in 3 out of 45 cases. Blumenthal R (2006)[11] discussed that metal objects may show signs of fusing, zincification, cuprification and/or magnetization. Metallic objects such as tooth fillings, spectacles, belts, buckles, coins and pacemakers should be specifically commented on. This is usual finding seen in lightening.

Singed hairs were noted in 20 (42.55%) cases. Bluementhal R (2005)[5] and Wetli CV (1996)[6] also found consistent findings.

In the present study cardio-pulmonary arrest following lightening was most common i.e. in 38 (80.85%) cases which lead to immediate death of the victim, followed by burns 5 (10.65%) and 2 (4.25%) each by head injury and pulmonary infarct. The initial response of lightning stroke is paralysis of the vital centers, specifically respiratory center, resulting in apnea, ventricular fibrillation or cardiac arrest. Cardiac arrhythmias are very common with lightning strokes.[12,13]

Reference:

1. Maio Di Vincent JM, Dana Suzanna E. In: Handbook of forensic pathology. Landes biosciences. 1999. p. 195–7.
2. Aslar AK, Soran A, Yildiz Y, Isik Y. Epidemiology, morbidity, mortality and treatment of lightning injuries in a Turkish burns units. Int. j. clin. pract. 2001;55:502-504.
3. Abrol A, Saraf R, Singh S. Thermal and Electrical Burns in Jammu Province. Journal of Jammu and Kashmir science 2005 April-June;7(2).
4. Murty OP, Kian CK, Husin MHA, Nanta Kumar RK, Mohammed Yusuf WYW. Fatal lightning strikes in Malaysia: A review of 27 fatalities. The American Journal of Forensic Medicine and Pathology 2009;30(3): 246-251.
5. Blumenthal R. Lightening fatalities on the South African Highveld: A retrospective descriptive study for the period 1997 to 2000. The American journal of forensic medicine and pathology 2005, Mar.;26(1):66-69.
6. Wetli CV. Keraunopathology: an analysis of 45 fatalities. . The American journal of forensic medicine and pathology 1996;17(2):89–98.
7. Duclos PJ, Sanderson LM. International Journal of Epidemiology 1990;19: 673-679.
8. Sophie Pointer, James Harrison. Electrical injury and death. AIHW National surveillance unit, research centre for injury studies. Flinders University. South Australia, April 2007.
9. Mills B, Unrau B, Parkinson C, Jones B, Yessis J, Spring K. Striking Back: An Assessment of Lightning-related Fatalities and Injuries in Canada. Final technical report September 2006. p. 1-38.
10. Curran EB, Holle RL, Lopez RE. Lightning casualties and damages in the United States from 1959 to 1994. Journal of Climate 2000;13:3448-3464.
11. Blumenthal R. When thunder roars - go indoors. SAMJ. 2006 Jan.;96(1).
12. McCrady-Kahn V, Kahn Arthur M. Lightning burns. West J Med. 1981;134: 215–219.
13. Apfelberg DB, Masters FW, Robinson DW. Pathophysiology and treatment of lightning injuries. J Trauma. 1974;14:453– 460.

Original Article

RETROSPECTIVE STUDY OF AUTOPSY CASES OF FATAL TRAUMA IN CHILDREN IN A MEDICAL COLLEGE HOSPITAL IN RURAL AREA

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Original Article

RETROSPECTIVE STUDY OF AUTOPSY CASES OF FATAL TRAUMA IN CHILDREN IN A MEDICAL COLLEGE HOSPITAL IN RURAL AREA

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Abstract:

Injury and violence are major killers of children throughout the world, responsible for about 950000 deaths in children and young people under the age of 18 years each year. In 1990, injuries in the developing countries contributed to 13% of total disability adjusted life years among children. It is expected that by 2020, this share will increase to 22%.

Even in India injuries are emerging as a considerable public health problem, having one of the highest childhood disability-adjusted life year rates attributable to injuries. To implement preventive measures for injury reduction, data regarding childhood injuries should be available. Retrospective study was conducted in a medical college hospital in a rural area to assess the magnitude and causes of fatal injuries among the children. 81 autopsy reports of fatal trauma cases in children were studied in detail to assess the cause and other information.

Out of 81 fatal trauma cases majority of victims were in the age group of 13-17 years and were males (53%). Road traffic accidents (RTA), drowning and falls were leading causes of death.

Fatal trauma is one of the commonest finding in autopsies of children. Males in the age group of 13-17 years are commonly involved and Road traffic accidents, drowning and burns were the leading causes of death

Key words: Fatal trauma, autopsy, children

Introduction:

The landmark Convention on the Rights of the Child, ratified by almost all governments, states that children around the world have a right to a safe environment and protection from injury and violence. However childhood injury (trauma) is a major public health problem that requires urgent attention.

Injuries are a significant area of concern from the age of one year, and progressively contribute more to overall rates of death until children reach adulthood. Unintentional injuries are the biggest threat to their survival and are also a major cause of disabilities, which can have a long-lasting impact on all facets of children's lives.

Injury and violence are major killers of children throughout the world, responsible for about 9,50,000 deaths each year in children and young people under the age of 18 years.[1] Unintentional injuries account for almost 90% of these cases. Injuries are responsible for 30% of deaths in 1–3 year olds, with the figure approaching 40% in 4-year olds and 50% to 60% among those aged 5 to 17 years in South East Asia. [2].

The vast majority of child injury deaths occur in low and middle income countries where the injury mortality rate among those aged less than 15 years is five times higher than that in the high-income countries.[3]Recent large-scale community-based surveys conducted in five countries in South and East Asia , revealed much higher levels of death from injury among the children.[4]In 1990, injuries in the developing countries contributed to 13% of total disability adjusted life years among children. It is expected that by 2020, this share will increase to 22% [5]

In India also, injuries are emerging as a considerable public health problem, having one of the highest childhood disability-adjusted life year rates attributable to injuries. [5,6] Road traffic accident (RTA) was the second leading cause of death and burden of disease among 5–14 years old in India in the year 2000.[7]

The burden of disease due child injuries have been neglected for many years, and are largely absent from child survival initiatives on the global agenda and little attention had been paid to the issue of childhood injuries in low-income and middle income countries. Because of the lack of awareness of this problem effective measures have not been implemented. To implement preventive measures for injury reduction, data regarding childhood injuries should be available ,wide scale surveys should be carried out to collect the data. Present study was conducted in a tertiary health center in a rural area to assess the magnitude and causes of fatal injuries among the children.

Materials and methods:

Study design: Retrospective record based study

Study set-up: Mortuary of Rural Medical College, Loni provides services to more than 5 talukas of Ahmednagar (Rahata, Rahuri, Sangamner, Shrirampur, Kopergaon, Akole)

Study participants: All autopsy cases of children conducted during 2005-2007.

Inclusion criteria: Autopsies of children

Exclusion criteria: Autopsies in Adults

Sample Size: 105 cases (within a duration of 3 years from 2005-2007)

Data Collection: After obtaining the permission from conducting the study from the concerned authority, retrospective data of 3 years (2005-2007) was collected from autopsy reports maintained in the department of Forensic Medicine &Toxicology. Out of the total number (105 cases) of autopsies conducted among children, 81 victims died due to trauma. The demographic data type of trauma, manner of injury and cause of death were recorded. The data were compiled and analyzed by using appropriate statistical techniques.

The definition of injury used in present study was “the physical damage that results when human body is suddenly subjected to energy in amounts that exceed the threshold of physiological tolerance – or else the result of a lack of one or more vital elements, such as oxygen”[8]

Results:

There were one hundred and five autopsies of children during the period of 3 years (2005-07) at the Post-Mortem centre of Rural Medical College, Loni. Among the total 105 autopsies 81 cases (77%) had died due to trauma.

The males (53%) were more involved in traumatic deaths than females (47%). The majority of male victims were from the age group of 12-17 years (17%) followed by 9-12 years (14%); females also followed the same pattern with 22% deaths in 12-17 years. Particularly victims from the age of 6-9 years were least affected. (Table no 1)

The leading manner of death was Road Traffic Accidents (RTA) (35%) followed by drowning (17%). Mechanical trauma accounted for 44% of deaths, asphyxial trauma (drowning) - 18%, Chemical Poisoning-17%, Burns -11%, animal bites 10%, electrocution – 7% and falls 9% (Table no. 2).

Analysis of causes of death showed following results:

Age (years)	Male No.(%)	Female No.(%)	Total %
0-3	08(9.9%)	06(7.4%)	14(17.2%)
>3-6	08(9.9%)	05(6.2%)	13(16%)
>6-9	02(2.5%)	04(4.9%)	06(7.4%)
>9-12	11(13.6%)	05(6.2%)	16(19.7%)
>12-17	14(17.3%)	18(22.2%)	32(39.5%)
Total	43(53.1%)	38(46.9%)	81(100%)

Table No. 1: Demographic Distribution of Autopsy Cases (n=81)

Manner	Total No.	%
RTA	28	35%
Drowning	14	17%
Burns	09	11%
Chemical Poisoning	09	11%
Snake Bite	08	10%
Electrical Injuries	06	7%
Fall	07	9%
Total	81	100%

Table No. 2: Distribution of Autopsy Cases according to manner of Death

Craniocerebral injury was the commonest nature of fatal trauma in the present study. The craniocerebral Injury (CCI) was a leading cause of death among the victims of RTA followed by asphyxia which was common among drowning victims. (Table 3)

Mechanism of Trauma	Cause of Death	Total
Road Traffic Accidents	CCI	15
	Non- CCI	13
Drowning	Asphyxia	14
Poisoning	Poisoning	09
Burns	Septicemia	04
	Shock	04
	Toxaemia	02
Snake bite	Toxemia	07
Electric injury	Cardio-respiratory failure	04
Fall	CCI	02
	Non-CCI	02
Others	CCI	03
	Cardiac Failure	02
	Traumatic Asphyxia	01
Total		81

Table No. 3: Distribution of Autopsy cases according to Mechanism of trauma.

Discussion:

In the retrospective study of 105 autopsies of children, 81 (77%) children died due to fatal injury. Injury rate was more among the age group of 12-17 years followed by 9-12 years and males were more affected than females. Similar findings were observed by Chaudhari et al and Singh et al in their studies. [9-10] As per World Health report 2004, deaths due to injuries were more common in the age group of 13-16 years followed by 9-12 years. Rivara and

Chowdhury et al reported that the incidence of injury was more common among boys as compared to girls. In each age group males were at higher risk than females. [11-12]

The factors that lead to this increased risk for males are complex and difficult to untangle. They may include inborn differences in behavior, as well as obvious differences in exposure related to traditional male and female roles in our society.

The leading causes of death in our study were road traffic accidents followed by drowning, burns, falls and poisioning. Similar order of causes was observed in study conducted in South Africa and Bangladesh.[12-13]

In the present study craniocerebral injuries were common in RTA in children due to the fact that the head constitutes a larger portion of the body than in adults.

Deaths due to asphyxial trauma were common due to drowning for that fact that children in rural area like to bathe in canals which are more than 5 feet deep. Chemical burns were due to the fact that like adults even children from rural set up are exposed to various pesticides which are highly poisonous when consumed as well as highly-inflammable when played with fire sources around. Falls from heights are not common in rural setup for the fact that there are very few construction sites, buildings and towers etc .

Conclusion:

Fatal trauma is one of the commonest finding in autopsies of children. Males in the age group of 13-17 years are commonly involved and Road traffic accidents, drowning and burns were leading causes of death.

Recommendations:

Since majority of the traumatic deaths were due to RTA and drowning, the following preventive measures can be suggested to avoid such unnatural deaths in future:

1. Rules of Motor Vehicle Act (MVA) should be stricter to control the accidents and pass a message to common peoples to avoid the trauma due to MVA. Awareness about rules imparting compulsory road safety education to school children should be spread from primary education level.
2. Provisions should be made for training of Emergency Department (ED) personnel and other “first contact” personnel in skills for early detection and brief intervention. Moreover, appropriate medical care facilities (including trauma centers) need to be established at rural level, sub-divisional and block levels to provide prompt and quality care to head injury patients.

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References:

1. Global burden of disease, 2004. Geneva, World Health Organization,2008
2. Begg S, Tomijima N. Global burden of injury in the year2000: an overview of methods. Geneva, World Health Organization,2003.
3. Peden M., Oyegbite K., Ozanne-Smith J., editors. World report on child injury prevention. World Health Organization; Geneva: 2008
4. Linnan M et al. Child mortality and injury in Asia: policy and programme implications. Florence, UNICEF InnocentiResearch Centre, 2007 (http://www.unicef-

irc.org/publications/pdf/iwp_2007_07.pdf, accessed 21 January2008). (Innocenti Working Paper 2007-07, Special serieson child injury No. 4).

5. Deen J.L., Vos T., Huttly S.R., Tulloch J. Injuries and non communicable diseases: emerging health problems of children in developing countries. Bull World Health Organ. 1999;77:518–524.
6. Dandona R., Kumar G.A., Ameer M.A. Incidence and burden of road traffic injuries in urban India.Inj Prev. 2009;14:354
7. Krug E. World Health Organization; Geneva: 1999. Injury: a leading cause of the global burden of disease
8. International statistical classification of diseases and relatedhealth problems, tenth revision. Volume 1: Tabular list;Volume 2: Instruction manual; Volume 3: Index. Geneva,World Health Organization, 1992–1994.
9. Chaudhari R.S. &Apte V.V. Autopsy study of Fatal Trauma in Children. BHJ 1995, 37(2):350-352.
10. Harnam Singh, AggarwalFatal Road Traffic Accidents among Young Children JIndian Acad Forensic Med, *32(4)* ISSN 0971-0973 286
11. Rivara F "Epidemiology of childhood injuries. I. Review of current research and presentation of conceptual framework," American Journal of Diseases of Children, vol. 136, no. 5, pp. 399–405, 1982
12. ChowdhuryS,RahmanA,Mashreky S,Giashuddin, Rahaman F "The Horizon of Unintentional Injuries among Children in Low-Income Setting: An Overview from Bangladesh Health and Injury Survey"Journal of Environmental and Public Health Volume 2009 (2009),
13. Stephanie Burrows S [a], Niekerk A ,Laflamme L "Fatal injuries among urban children in South Africa: risk distribution and potential for reduction" *Bulletin of the World Health Organization* 2010;88:267-272

Original Article

A CLINICAL STUDY OF DIABETIC MACULAR EDEMA

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Original Article

CLINICAL STUDY OF DIABETIC MACULAR EDEMA

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Introduction:

In the year 2000, there were around 171 million people with diabetes globally, and by 2030, it is estimated that this number would increase to 366 million[1.] As the number of persons with diabetes increases, the development of microvascular complications like retinopathy, nephropathy and neuropathy also rises. These microvascular complications are linked to the duration of diabetes mellitus, poor glycemic control and systolic hypertension[2.] The magnitude of damage caused by these microvascular complications of diabetes stresses the need for sensitive markers of screening for retinopathy and nephropathy. The sensitive marker for the detection of diabetic nephropathy is to estimate excretion of microalbumin in urine; and for the detection of diabetic retinopathy (DR), to have a fundus evaluation after pupillary dilatation[3,4] The common cause of visual impairment in diabetic retinopathy include macular edema,macular ischemia and complications due to proliferative retinopathy.Diabetic macular edema (DME) is the most common cause of visual impairment in patients with diabetes mellitus[5].The majority of diabetics have type 2 diabetes,wherein macular edema is commoner. Microalbuminuria thus is an important warning sign for both the physician and the patient which if ignored can lead to irreversible renal damage. Microalbuminuria is most commonly associated with other microvascular complications of diabetes namely retinopathy, neuropathy, and ischemic heart disease. So microalbuminuria may be a marker for widespread microvascular damage in a patient of diabetes mellitus.

Key Words: Diabetic MacularEdema

Aims:

To study clinical pattern of Diabetic macular edema in patients with diabeticretinopathy in Diabetes mellitus type 2 (NIDDM) patients, assess the associated visual impairment and correlate with types of maculopathy and find association between DME and diabetic nephropathy(Albuminuria)

Material & methods:

Patients who presented to our outpatient department andinpatients referred from other departments were evaluated as per inclusion and exclusion criteria and a total of 60 patients were selected for the study. The patients were grouped as Type 2 Non-Insulin dependent diabetes mellitus (NIDDM).

An informed written consent was obtained in every case. A detailed ocular history and medical history was taken. An elaborate ocular examination was performed. Biomicroscopic examination of the anterior segment was performed to identify any abnormality. The best corrected visual acuity was recorded for distance vision.TheIOP was recorded by Goldmann'sApplanation Tonometer.

Subjects with type 2 diabetes were identified based on the American Diabetes Association criteria.[6]Blood sugar level was monitored using glucometer and the patients were labelled as diabetic with-Fasting BSL more than 130mg/dl and Post prandial BSL more than 180 mg/dl. A morning urine sample was tested for albuminuria. Subjects were considered to have albuminuria, if the urinary albumin excretion was > 30 mg/24 hours. A detailed fundus

examination was done by direct, indirect ophthalmoscope and slit lamp biomicroscopy using 90D Volk lens.

Retinal photographs were taken after pupillary dilatation (TOPCON fundus camera); all patients underwent 45°four-field stereoscopic digital photography. For those who showed evidence of any DR, additional 30° seven field stereo digital pairs were taken. The patients were investigated by intravenous fundus fluorescein angiography using TOPCON Fundus Camera.

Statistical analysis:

Statistical analysis was performed by the SPSS program forWindows, ver.16.0.Continuous variables are expressed as mean ± SD,and categorical variables are presented as absolute numbers and percentage.Categorical variables were analysed using the Chi-square test.For the statistical test,a p value less than 0.05 was taken to indicate a significant difference.

Observations:

Out of 60 patients of DME under study,28 patients(46.4%) had unilateral DME whereas 32 patients(54.6%) had bilateral DME.

1. In the study patients, the duration of diabetes mellitus ranged from 0-25 years. Among the 60 patients, 20 patients had diabetes mellitus since 6-10 years, 15 patients since 11-15 years, 10 patients since 16-20 years, 11 patients since less than 5 years and 4 patients from 20-25 years. Mean duration was 11.1 ± 6.1 years.
2. Among the 120 eyes of 60 patients studied, diabetic maculopathy was found in 92eyes. As assessed by FFA focal macular edema was found in 35 eyes(38%), diffuse macular edema including cystoid macular edema was found in 29 eyes(31.5%), Ischaemic maculopathy in 11 eyes(11.9 %) and mixed maculopathy in 17 eyes(18.6%).
3. Among the 92 eyes with diabetic maculopathy, best corrected visual acuity ranged from 6/6 to CF1m. 2 eyes (2.1%) had visual acuity of 6/6, 26 eyes (28.2%) had 6/9, 7 eyes (7.6%) had 6/18, 9 eyes (9.7%) had 6/36, 20 eyes (21.7%) had 6/60,16 eyes (17.3%) had CF3m and 12 eyes(13.4%) had vision CF1m.
4. Among the 60 patients with CSME, 60 patients had macular edema in one or both the eyes. Among the 60 patients with macular edema,16 patients(26.7%) had mild degree of macular edema whereas 18 patients (30%) had moderate and 26(43.3%) patients had severe type of macular edema.
5. Among the 60 patients with diabetic macular edema, Urine Albumin concentration > 30 mg/24 hr or albuminuria was found in 28 patients(46.7%) and absent in 32 patients (53.3%).
6. Among the 60 patients with DME under study, 28 patients had albuminuria (proteinuria).Out of 28 patients with albuminuria,5 patients(17.9%) had mild macular edema,whereas 6 (21.4%) and 17 patients (60.7%) had moderate and severe macular edema respectively. Urine albumin excretion>30mg/24 hours or albuminuria found significant difference or association with severity of diabetic macular edema(p=0.039).

Results:

120 eyes of 60 patients were included in this study all of them with someform of CSME. Among the 120 eyes of 60 patients studied, diabetic maculopathy was found in 92eyes. As assessed by FFA focal macular edema was found in 35 eyes(38%), diffuse macular edema including cystoid macular edema was found in 29 eyes(31.5%), Ischaemic

maculopathy in 11 eyes(11.9 %) and mixed maculopathy in 17 eyes(18.6%). Out of 60 patients of DME under study,27 patients(45%) had unilateral DME whereas 33 patients(55%) had bilateral DME. 34 eyes (36.6%) had severe NPDR, 24 eyes (25.4%) had very severe NPDR, 15 eyes (16.9%) had moderate NPDR, 10 eyes (11.3%) had low risk PDR and 9 eyes (9.9%) had high risk PDR. Among the 60 patients with diabetic macular edema, Urine Albumin concentration > 30 mg/24 hours or albuminuria was found in 28 patients(46.7%) and absent in 32 patients (53.3%).28 patients had albuminuria (proteinuria).Out of 28 patients with albuminuria,5 patients(17.9%) had mild macular edema,whereas 6 (21.4%) and 17 patients (60.7%) had moderate and severe macular edema respectively.

Conclusion:

Diabetic maculopathy occurred commonly in type 2 diabetes patients within first 10 years of onset of disease.

Fluorescein angiography showed higher frequency of focal macular edema due to leakage from microaneurysms and diffuse macular edema due to leakage from retinal capillary bed and intraretinalmicrovascular abnormality. Visual acuity loss was more in diffuse edema as compared to focal edema. Normal vision was noted in patients with focal macular edema due to sparing of fovea.

Diabetic maculopathy can occur even with normal vision. Preservation of sight is of great importance in maculopathy since improvement in vision is uncommon in spite of best treatment. This highlights the importance of detailed fundus examination by slit lamp biomicroscopy in all cases of diabetic retinopathy for early and prompt diagnosis.

Further ancillary investigation by FA helps in delineating the type and extent of lesion and in assessing the severity and prognosis. FFA also serves as a guide in laser photocoagulation and for followup after treatment and for retreatment.

Patients with albuminuria (microalbuminuria or macroalbuminuria) are more likely to have diabetic retinopathy and diabetic macular edema as compared to those without albuminuria.

We found an important metabolic disbalance in most of the patients, and a significant relationship between macular edema and albuminuria. Albuminuria could be used as a risk marker for the development of diabetic macular edema.

References:

1. Wild S, Roglic G, Green A, Sicree R, King H: Global prevalence of diabetes: estimates for the year 2000 and projections for 2030**.***DiabetesCare* 2004, 27**:**1047-1053.
2. Unnikrishnan RI, Rema M, Pradeepa R, Deepa M, Shanthirani CS, Deepa R, Mohan V:Prevalence and risk factors of diabetic nephropathy in an urban South Indian population: the Chennai Urban Rural Epidemiology Study (CURES 45).*Diabetes Care* 2007, 30**:**2019-2024.
3. Prevalence of small vessel and large vessel disease in diabetic patients from 14 centers. The World Health Organization Multinational Study of Vascular
4. Disease in Diabetics. Diabetes Drafting Group. Diabetologia 1985, 28 9Suppl): 615-640.
5. Sobngwi E, Mbanva JC, Moukouri EN, Ngu KB: Microalbuminoria and retinopathy in a diabetic population of Cameroon. Diabetes Res Clin. Pract 1999, 44:191-196.
6. Diagnosis, Management and Treatment of NPDR: Principles and Practice of Ophthalmology by Albert &Jakobiec.
7. American Diabetes Association: Tests of glycemia in diabetes. Diabetes Care 2003, 26(Suppl 1):106-108.

Original Article

A COMPARATIVE STUDY OF TREATMENT OF FRACTURE SHAFT HUMERUS BETWEEN CONSERVATIVE AND SURGICAL METHODS WITH EMPHASIS ON CONSERVATIVE TREATMENT

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Original Article

A COMPARATIVE STUDY OF TREATMENT OF FRACTURE SHAFT HUMERUS BETWEEN CONSERVATIVE AND SURGICAL METHODS WITH EMPHASIS ON CONSERVATIVE TREATMENT

Dr. PS Bhandari, Dr. SR Puri

Abstract:

This is an era of developing mechanization, industrialization and rapidly moving two and four wheelers on poor quality roads in our country. Fracture shaft humerus is a common occurrence due to vehicular accidents, falls on play grounds, roads and industrial set up. They are usually associated with head injury, blunt trauma chest, abdomen and fracture of forearms. Our hospital has patient drainage from tribal districts like Dhule and Nandurbar. Most of these patients avoid longer durations of hospitalization following surgical treatment in view of losing their daily wages. In such situations it becomes very difficult to perform fixation of these fractures by using newer implants and techniques, and makes us to think over the alternative techniques like Arm to Chest strapping, U+AE slab and Hanging Arm cast. It is generally accepted that mostof the fracture shaft humerus are healed by conservative means in all acceptable positions and gives satisfactory results.

Key Words: Fracture Humerus, Conservative treatment

Introduction:

The most acceptable classification of Fracture shaft humerus is:

a. Fracture above the insertion of pectoralis major (proximal humerus fracture)
b. Fracture below the insertion of pectoralis major & above the insertion deltoid (diaphyseal fracture)
c. Fracture below the insertion deltoid (distal humerus fracture)

Other classifications of general fractures such as Gustillo Anderson, AO/ASIF are also applicable for Fracture shaft humerus.

Materials & Methods:

Over a period of 18 months in Department of Orthopedics at SBH Government Medical College Dhule (Maharashtra), 40 cases of fracture shaft humerus were studied. On admission details of history about mechanism of trauma, symptoms and findings of clinical examinations were noted. X-ray examination and routine investigations and in some cases specific other investigations are performed in view of PAC and Physician's fitness.

In 20 patients, who were having simple, stable & un-displaced fractures, conservative method was preferred and out of them 12 were treated by Hanging Arm, cast, 6 were treated by U+AE slab & 2 were treated by Arm to Chest strapping.

Rest twenty patients who were having compound, segmental, spiral displaced, comminuted fractures and the fractures associated with Radial nerve injury treated by Open Reduction & Internal Fixation by using Dynamic Compression Plate in which Anterolateral Approach was preferred in 12 cases and Posterior Approach was preferred in 8 cases.

Post operative physiotherapy and meticulous follow-up fortnightly for 2 months and monthly for 6 months was done. During follow-up patients were examined for signs of clinical and radiological union, time taken for union, and presence of complications like joint stiffness, infection and angulations. Patients were evaluated according to above criteria and results were graded as excellent, good, fare and poor.

Observations & Discussion:

In this study due to their occupations and habitat involving outdoor activities, males constituted 70% of the study group and 75% of them belonged to the age group of 11-50 years. As compared to Griend et al series we also observed that 62.5% cases had middle third diaphyseal fracture on left side and mechanism of injury was RTA. Prevalence of short oblique fracture was maximum (17 patients) followed by transverse fracture in 11 and spiral fracture, comminuted fracture and transverse fracture with butterfly in 4 patients each.

In the patients treated conservatively, angulations of more than 30 degrees and stiffness of shoulder joint of more than 30 degrees were observed in one patient each. As compared to Griend et al non-union was found in single patient due to distraction of Hanging cast, he was treated later by ORIF with DCP and BG. That means in only 10% cases functional status of patient was affected conservative method.

While in series of cases treated by surgical method, post-operative infection was observed in 20% and stiffness of shoulder and elbow of more than 30 degrees was observed in 30%. The rate of complication was 50% by surgical method and 25% by conservative method. The average time required for union by conservative method was 14.3 weeks and by surgical method was 17.4 weeks. 25% cases showed union in 12 weeks when treated conservatively while in 40% cases treated surgically. 20% patients had taken more than 20 weeks to unite when treated surgically as compared to only 5% cases treated conservatively. So 85% cases had taken < 16 weeks to unite when treated conservatively as compared to 60 % cases treated surgically. This was due to the preservation of fracture hematoma and non-handling of surrounding soft tissues.

Associated Radial Nerve Palsy:

In our series of patients RNP was observed in 4 patients (10%) on admission and in single case (2.5%) after attempting closed reduction. Out of them in 2 cases there was fracture of middle third and in 3 cases fracture of distal third. As recommended by Holstein & Levis, in all 5 cases RN was explored by posterior approach. Out of 5 in 3 cases RN was found contused and in 2 cases it was found normal. Out of five in 60% complete recovery observed in 4-8 weeks, while in 40% partial functions were restored with some weakness of wrist and digital extensors by 24 weeks, who were advised to use Dynamic Koch-up splint .

Results:

Excellent results were observed in 60% cases treated conservatively and in 30% cases treated surgically. 40% cases treated conservatively had shown **Good** results as compared to 45% cases treated surgically. **Fare** and **Poor** results were found in 20% and 5% cases respectively in series of patients treated surgically while Fare and Poor results were not found in a single case in series of conservative method. This indicates that the conservative method gives superior results as compared to surgical method in study of series of these 40 patients.

Conclusion:

'An ability to do surgery is not necessarily an indication for surgery', keeping this in mind all simple fractures of shaft humerus without association with RNP should be given a liberal trial of conservative method. Surgical method should always be followed either on failure of conservative method or presence of features like compound fracture or associated RNP.

Fractures treated conservatively unite earlier than those treated surgically. Fractures of upper third and middle third unite satisfactorily when treated conservatively. Plating with

early exploration of RN, reduces incidence of shoulder and elbow stiffness because of early mobilization and hence gives good results due to early recovery of nerve function.

References:

1. Balfour GW et al, Diaphyseal fractures shaft humerus treated with a readymade functional brace JBJS, 64A ,11-13,1982
2. Bell MJ, Beauchamp CG Kellor. JK, The results of plating humeral shaft fractures. JBJS,67B,293-296,1985
3. Bostman OG Bakalim et al, Radial nerve palsy fractures shaft humerus. Acta orthop. scand. 57,316-19,1986
4. Caldwell JA, Treatment of fracture shaft humerus by hanging arm cast. Surg. Gyne.. Obst.70,421-23,1940

Original Article

A PROSPECTIVE CLINICAL STUDY OF POSTPARTUM HAEMORRHAGE IN RURAL POPULATION

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Original Article

A PROSPECTIVE CLINICAL STUDY OF POSTPARTUM HAEMORRHAGE IN RURAL POPULATION

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Abstract:

This study was designed as a hospital based prospective study, carried out at Government Medical College and Hospital, during period of November 2010 to October 2012. In present study maximum number of patients had PPH due to atonicity of uterus & number of PPH patients due to retained placenta is comparable with study carried out by Lumaan Sheikh et al. Overall majority of cases of PPH developed atonicity. In present study incidence of PPH decreased to almost 50% with use of AMTSL (Active Management of Third Stage of Labour). Study of Hope Johnson et al also showed that incidence of PPH decreases significantly after use of AMTSL. So AMTSL significantly reduces the incidence of PPH which is comparable. In present study maternal death rate was 64 per 100000 live births of the diagnosed cases of PPH which is less than the incidence in the studies carried out by Afaf et al. The lower death rate in our study might be due to earlier detection of PPH by using blood drape, to calculate exact amount of blood loss, active intervention and use of Nonpneumatic Anti Shock Garment. Hence, this indicates that early intervention and blood replacement even in compromised setup invariably brightens the chances of survival.

So early and accurate detection of blood loss, timely management and use of innovations like Nonpneumatic Anti Shock Garment reduces the risk of maternal death even in rural Indian setup where more than half of the maternal deaths are still caused by Postpartum Haemorrhage.

Keywords: AMTSL, PPH, Maternal Mortality.

Introduction:

Postpartum haemorrhage (PPH) is a worldwide problem and one of the three messengers of maternal death[2]. The exact incidence of obstetric haemorrhage is not known because of its imprecise definition as well as difficulty in its recognition and thus its diagnosis. Postpartum haemorrhage is the excessive loss of blood per vaginum after the delivery of the baby and up to 42 days postpartum. It can either be primary or secondary. Primary PPH is the loss of more than 500 ml of blood in case of vaginal delivery and more than 1000 ml in case of caesarean section within the first 24 hours of delivery. Factors that lead to increased incidence of PPH are mainly multiparity, preeclampsia, eclampsia, multiple gestation, anaemia, abruptio placentae, placenta praevia, polyhdramnios, instrumental vaginal delivery and prolonged labour. Although the presence of one or more of these factors may increase the chances of PPH in women, 2/3rd of PPH cases occur in women with no risk factor which is then termed as idiopathic. Presence of risk factors cannot be used to predict PPH; some studies have sought to determine whether the third stage of labour should be actively managed in all women giving birth to decrease the incidence of uterine atony which is the leading cause of PPH [3]. Active Management of Third Stage of Labour (AMTSL) is a three part process intended to augment uterine contraction and prevent PPH due to uterine atony[6]. The recommended protocol comprises use of uterotonic drug within 1 minute of the delivery of baby, delivery of placenta by applying controlled cord traction with counter traction over uterus and uterine massage after delivery of placenta. When AMTSL is practiced, oxytocin is the preferable prophylactic uterotonic[3]. Present study is an attempt to

evaluate the incidence, prevention, treatment and outcome of PPH by using different modes of management in rural setup[1].

Materials and Methods:

The present prospective study is carried out in Department of Obstetrics and Gynaecology in Rural Government Medical College and Hospital, during the period from November 2010 to October 2012. 20281 cases of labour were studied. In 1023 patients following protocol was carried out, the placenta was delivered by maternal effort aided by gravity or nipple stimulation and the cord was clamped when pulsation ceased. Oxytocin was given after delivery of placenta.

Active Management of Third Stage of Labour (AMTSL) was used in 19258 patients with following protocol: Uterotonic drug was given within one minute of the delivery of baby. Placenta was delivered by applying controlled cord traction with counter-traction over uterus. Uterine massage given after delivery of placenta.

Diagnosed cases were managed with emergency resuscitative measures, blood transfusion in the form of whole blood or blood components. Uterotonic agents such as inj. Oxytocin, inj. Ergometrine, inj. Carboprost (15 methyl PG $F_2\alpha$) and Tab. Misoprostol were used alone or in combination. In some cases surgical procedures like repair of genital lacerations in cases of traumatic PPH, manual removal of placenta in cases of retained placenta, selective devascularisation i.e. uterine and/ or ovarian artery ligation and/ or internal iliac artery ligation, uterine compression suture i.e. B-Lynch suture, and lastly Emergency Obstetric Hysterectomy were done.

Data analysis:

The data obtained on all PPH patients was tabulated in Microsoft Office Excel software and analyzed using SPSS version 17.0, the chi-square test was used in assessing the associations between categorical variables; a p-value of 0.05 or less was considered statistically significant.

Result:

In present study maximum number of patients i.e. 82.76% had PPH due to atonicity of uterus which is comparable with studies carried out by MA Ijaiya et al, Kant Anita et al, Farhana Yusuf et al who also had maximum number of PPH patients due to atonicity[3, 4, 5]. In present study number of PPH patients due to retained placenta is comparable with study carried out by Lumaan Sheikh et al. Cases of traumatic PPH in present study is comparable with study carried out by Lumaan Sheikh et al[6]. Overall majority of cases of PPH developed atonicity.

Table No. 1: Distribution of Patients According to Causes of PPH

Causes	No. of Cases (n=232)	Percentage
Atonic	192	82.76%
Traumatic	36	15.52%
Retained Placenta	4	1.72%

In present study incidence of PPH decreased to almost 50% with use of AMTSL. Study of Hope Johnson et al also showed that incidence of PPH decreases significantly after use of AMTSL. So AMTSL significantly reduces the incidence of PPH which is comparable[7].

Table No. 2: Incidence of PPH in Cases with and without Active Management of Third Stage of Labour (AMTSL).

Group	No. of Deliveries	No. of PPH Cases	Incidence of PPH
without AMTSL	1023	28	2.73%
with AMTSL	19258	204	1.06%
Total	20281	232	1.14%
Z Test = 16.35, p<0.001			

In present study out of total 232 cases 75.86% cases were recovered with medical management while 24.14% cases required surgical intervention, this is comparable with the study carried out by Shamshad et al[8]. In study carried out by HalderAtin et al and Tarik Y et al lesser number of cases were recovered by medical management while surgery was required in larger population which is not comparable with our study. Majority of cases of PPH can be tackled with uterotonics and blood transfusion. Use of newer uterotonics like prostaglandins is responsible for better response to medical management.

Table No. 3: Type of Management Required in Cases of PPH

Management	No. of cases	Percentage
Medical	176	75.86%
Surgical	56	24.14%
Total	232	100%

In present study maternal death rate was 64 per 100000 live births of the diagnosed cases of PPH which is less than the incidence in the studies carried out by Afafet al[9]. The lower death rate in our study might be due to earlier detection of PPH by using blood drape, to calculate exact amount of blood loss, active intervention and use of Nonpneumatic Anti Shock Garment. Maternal death in present study is comparable with studies carried out by Lumaan et al and Saharabhojanee et al[10] at advanced setup of Goa Medical College & Hospital Bombolim Goa, which has got better facilities like blood component separation unit and the study was carried out on emergency obstetric hysterectomy cases only. Hence, this indicates that early intervention and blood replacement even in compromised setup invariably brightens the chances of survival.

Table No. 4: Incidence of Maternal Death in Cases of PPH

Maternal Outcome	No. of cases	Per 100000 Live Births
Discharged	221	1089.68
Death	13	0064.09
Total	232	1153.77

So early and accurate detection of blood loss, timely management and use of innovations like Nonpneumatic Anti Shock Garment reduces the risk of maternal death[11] even in rural Indian setup where more than half of the maternal deaths are still caused by Postpartum Haemorrhage.

Table No. 5: Causes of Maternal Mortality during study period

Causes	No. of cases	Percentage
PPH	7	53.85%
Other Obstetric Haemorrhage	1	7.69%
Pre-eclampsia/ Eclampsia	1	7.69%
Infection	1	7.69%
Other	3	23.08%
Total	13	100%

Discussion:

As per the observations from Table No. 1 it is evident that the chief cause of PPH is atonicity of uterus (82.76% of cases) followed by traumatic PPH and retained placenta.

AMTSL as a routine protocol significantly brings down incidence of PPH. Table No. 2 shows that out of 1023 deliveries who did not receive AMTSL, 28 patients developed PPH and the incidence was 2.73%. While out of 19258 deliveries who had received AMTSL 204 patients developed PPH and the incidence was 1.06%. This difference in the incidence of PPH was statistically significant ($p<0.05$). Table No. 3 shows that 176 i.e. 75.86% of cases recovered with medical management and 56 i.e. 24.14% of cases required surgical management for the treatment of PPH. So most of the cases respond to timely management and still maternal mortality is inevitable in some cases like in this study incidence of Maternal Mortality was 64 per 100000 live births. (Table no. 4). During this study period 20281 women delivered in department and there were 13 maternal deaths. Table No. 5 shows that maximum 7 i.e. 53.85% of maternal mortality during study period was due to PPH.

Active Management of Third Stage of Labour (AMTSL) significantly reduces chances of atonic PPH by almost 50%. PPH accounts for more than 50% maternal deaths but early detection and timely intervention improves chances of survival.

References:

1. M.L. McCormick, H.C.G. Sanghvi, B. Kinzie, N. McIntosh.Preventing postpartum hemorrhage in low-resource settings, International Journal of Gynecology & Obstetrics 77; 2002.267-275.
2. Khan KSW. WHO analysis of causes of maternal death: a systematic review, Lancet 2006;367:1066"1074.
3. MA Ijaiya, AP Aboyeji and D Abubakar Analysis of 348 consecutive cases of primary postpartum haemorrhage at a tertiary hospital in Nigeria, Journal of Obstetrics &Gynaecology 2003; 23(4):374-377.
4. FarhanaYusuf, GulfareenHaider, Postpartum hemorrhage: an experience at tertiary care hospital, Journal of Surgery Pakistan (International) 14 (2) April - June 2009.
5. Kant Anita, WadhwaniKavita, Emergency obstetric hysterectomy, J ObstetGynecol India Vol. 55, No. 2 : March/April 2005 Pg 132-134.
6. Lumaan Sheikh, Nadeem F. Zuberi, RubabRiaz, Javed H. Rizvi, Massive primary postpartum haemorrhage: Setting up Standards of Care, J Pak Med Assoc, Vol. 56, No. 1, January 2006, pp 26-31.
7. Hope Johnson, Victor Rhee, Juliana Cuervo, and Manjunath Shankar, Active Management of the Third Stage of Labor, POPPHI, August-September, 2006, page 22.
8. ShamshadBibi, Nargis Danish, AnisaFawad, Muhammad Jamil, An audit of primary postpartum haemorrhage, J Ayub Med Coll Abbottabad; 2006; 19(4), pp 102-106.
9. Afaf R.A. Alsayali; Salah M.A. Baloul, Emergency Obstetric Hysterectomy: 8-Year Review at Taif Maternity Hospital, Saudi Arabia, Annals of Saudi Medicine, Vol 20, Nos 5-6, 2000, 454-456.
10. Sahasrabhojanee Mrinalini, Jindal Manjusha, Kamat Anjali, Obstetric hysterectomy: a life saving emergency, J Obstet Gynecol India Vol. 58, No. 2 : March/April 2008 pg 138-141.
11. Suellen Miller, Carol Camlin, David Nsima, Elizabeth Butrick, Obstetric hemorrhage and shock management: using the low technology Non-pneumatic Anti-Shock Garment in Nigerian and Egyptian tertiary care facilities, BMC Pregnancy and Childbirth 2010, 10:64.

Original Article

A RANDOMIZED STUDY TO EVALUATE SIA IN PATIENT OF SICS OPERATED BY CHEVRON AND FROWN INCISION

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Original Article

A RANDOMIZED STUDY TO EVALUATE SIA IN PATIENT OF SICS OPERATED BY CHEVRON AND FROWN INCISION

Dr. Dhiraj Balwir, Dr. Sidhdharth Yadav

Introduction:

In today's era, where cataract surgery is being considered a form of refractive surgery offering improvements in both best corrected and uncorrected visual acuity, one important aspect is post operative astigmatism. In small incision cataract surgery, the scleral pocket technique with different incision remains one of the best ways to have small, stable and secure incision. The importance of mastering the cataract incision cannot be overemphasized. A well constructed wound is the first step in successful surgery for both surgeon and the patient[1].

Geometric shape of the external incision affects the astigmatism significantly which is explained by incisional funnel. It is bound by a pair of lines whose shape is based upon the relationship between astigmatism and two characteristics of incision length and the distance from the limbus. Any incision made within this funnel will be astigmatically stable. Obviously, in SICS, parallel incision goes out of the funnel. A sight pulling causes big tension on its lips and brings a gaping of the wound and appearing of astigmatism against the rule. On the contrary, frown and chevron incisions lie entirely within the funnel so these are astigmatically more stable incisions a big amount of force is required to produce a small gap of angular incision.

In our institute, we observed 100 eyes to study incision induced astigmatism with 2 different shapes Chevron and Frown of same size and we demonstrated that Chevron incision has more stable configuration in terms surgically induced astigmatism. Chevron Incision was described by Pallin[2]. Frown incision was popularised by Singer[3].

Key Words: Astigmatism, SIA, SICS, Chevron incision, Frown incision

Materials and Methods:

The study was prospective and all the patients selected had cataract range from nuclear sclerosis grade I to grade IV and V with normal anterior and posterior segments. To find a more homogeneous population all patients were operated by single surgeon and all patients underwent similar preoperative, intra operative & postoperative surgical protocols. Patients with any ocular disease other than cataract, any intra operative complication, wound related problems and eye with 'against the rule astigmatism' were excluded from the study.

Eyes to be operated were divided into 2 groups. In Group A 50 eyes were operated with SICS with Chevron incision and in Group B 50 eyes were operated with SICS with Frown incision. All eyes were operated under peri bulbar anaesthesia with 2% Lignocaine. Superior sclero corneal pocket tunnel with external incision of 2 different configuration Chevron and Frown were made.

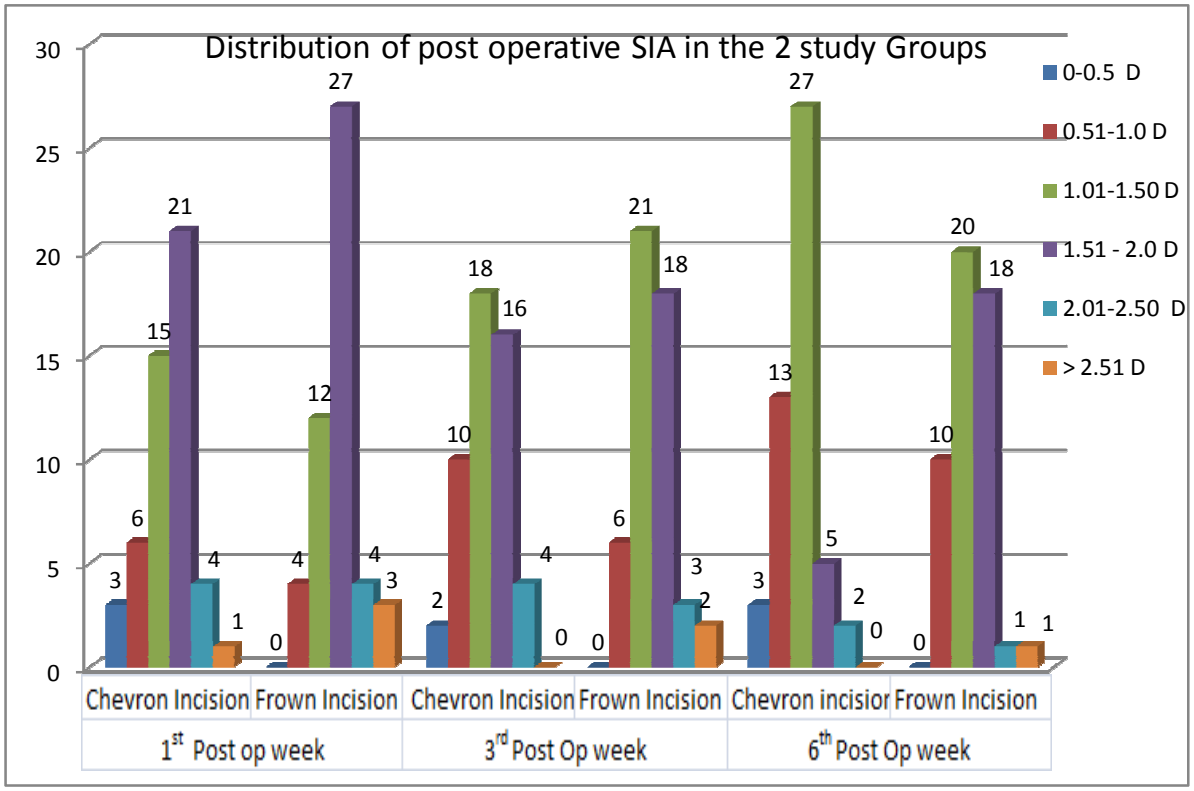
In cases of frown incision a parabolic groove convex towards limbus was made 1.0 mm behind the limbus centered at 12 o'clock and in cases chevron incision; triangular inverted 'V' incision was created with its apex placed 1.0 mm from the limbus. The angle between the limbs had to be 100^0-110^0. A dissection was done on each side of the tunnel. The measurement and the configuration of scleral corneal tunnel created a pocket large enough with sufficient place for the nucleolus to pass through. Anterior capsular hexis was made

anterior chamber was entered and hydro-dissection was done. The nucleus was brought to the anterior chamber and delivered out. Cortex was removed with simcoe cannula and rigid PMMA 6.0 mm IOL was put using visco elastic, which was aspirated out at last and a/c was formed with normal saline. Self sealing incision was not sutured and checked for its stability and leakage and conjunctiva was reposited back. Postoperatively, eyes were treated with antibiotic steroid combination with tapering dose and cycloplegic drug which was stopped after a week. Post operative follow up was at one week, 3 weeks and 6 weeks and astigmatism was assessed in each follow up with keratometry and topography

Results:
At the end of 6 weeks, chevron incision was found to be more stable in terms of induced astigmatism. Following are the results

Surgically Induced Group-A Group-B Astigmatism (Chevron) (Frown)

Groups	0--0.5	0.51--1	1.01--1.5	1.51--2	2.01--2.5	> 2.5
Chevron Incision	3	13	27	5	2	0
Frown Incision	0	10	20	18	1	1



Study shows that chevron incision gives very little amount of induced astigmatism up to 1.5 D in major proportion of eyes (86%) had vision better than or equal to 1.5D and only 4% eyes were found to have induced astigmatism > 2.0 D. On the contrary, with frown incision, 36% eyes had induced astigmatism between 1.51 – 2.0 D and 4% eyes showed > 2.0

D induced astigmatism. The mean SIA of Chevron incision was 1.17 ± 0.41 and of Frown Incision was 1.40 ± 0.45 the difference between the two mean SIA was statistically significant. (p= 0.006).

Discussion:

Though in non stitch small incision non Phaco cataract surgery, both chevron incision and frown incision are comparable because both incisions lie entirely within the incisional funnel, our study shows that chevron incision gives minimal amount of induced astigmatism. This is because of its triangular configuration which is geometrically more stable incision causing minimum sliding of the tips of the incision postoperatively. Majority of cases (86 %) show minimal amount of induced astigmatism with chevron incision of up to 1.5D induced astigmatism with 6.5 mm and only 4 % eyes were found to have significant induced astigmatism >2.0 D.

In Chevron incision group only 14% of patients had SIA of more than 1.5D while in Frown Incision Group this number went up to 40%.

The results are comparable to the study of **IsakovItzhak et al**[4] and also the study of Journal of Cataract Refractive Surgery 1990 Nopv, 10(6) 179-81.

The results were also similar to the study conducted by **JigishaRanderiet al**[5]**.**

Today, where the phaco surgery is not feasible, SICS with chevron incision is the best alternative which meets the surgeon's challenge for early postoperative rehabilitation and management of astigmatism.

References:

1. Ramon C Ghanem and Dimitri. T. Azar. Astigmatism and Catract Surgery. In Daniel M Albert, Joan W Miller editors. Principles and Practice of Ophthalmology. 3rd Edition. Elsevier.2009. Chapter 120.Page.1518.
2. Singer JA. Frown incision for minimizing induced astigmatism after small incision cataract surgery with rigid optic intraocular lens implantation. Journal of Cataract & Refractive Surgery. 1991; 17:677–88.
3. Pallin SL. Chevron incision for cataract surgery. Journal of Cataract & Refractive Surgery. 1990; 16:779–81.
4. Burgansky Z, Isakov I, Avizemer H, Bartov E. Minimal astigmatism after sutureless planned extracapsular cataract extraction. Journal of Cataract & Refractive Surgery. 2002; 28:499–503.
5. Dr. JigishaKiranRanderi , Dr. Rupam J. Desai , Dr. Falguni S. Mehta , Dr. O.P. Billore, Dr. Aruna Gupta , DrGautamKukadia "Incision induced astigmatism – A Comparative study of Chevron Incision and Frown Incision in SICS; AIOC 2008 proceedings.