

## ORIGINAL ARTICLE

# HISTO-MORPHOLOGY OF AGE OF CONTUSIONS: AN AUTOPSY STUDY

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## ABSTRACT

**Background:** During forensic evaluation the determination of age of contusions play a very important role. Age of contusions is normally determined based on their colour. Different authors have different interpretations of age of contusions based on colour.

**Objective:** The aim of the present study is to have a first hand information regarding the colour changes occurring in contusions with the passage of time, in our population and also to compare the aging process of contusions in our population with the standard data available.

**Methods:** Contusions were classified into small, medium and large. Both naked eye examination of colour of contusions and microscopic examination of contusions were done. Perl's staining was also done to confirm the presence of pigments.

**Results:** 65 male and 15 female patients were included in the study. Majority of the cases the contusions were due to road traffic accidents. It was observed that in contusions of 24 hrs duration it was red in colour, followed by blue colour for two to three days. Contusions of four to six days were bluish black coloured and green in colour by seventh day. Microscopic examination revealed the presence of RBC in injuries less than 24 hrs duration. Lymphocytes and polymorphs were prominent in third and fourth day of injury. Perl's stain was positive from the fifth day onwards.

**Conclusion:** The observations of colour tone of injury and histopathological findings including special staining techniques like perl's stain can help the forensic pathologist to a certain extent in dating the age of medium sized contusion in moderately nourished adult subjects during the initial phases of injury.

**Keywords:** Histomorphology, Age, Contusion, Injury, Bruise

## INTRODUCTION

Contusions are a major group of mechanical injuries produced by blunt force<sup>1</sup>. It is defined as infiltration of extravasated blood into the subcutaneous tissues resulting from rupture of small blood vessels due to application of blunt force. The accurate interpretation of bruising is essential at necropsy in order to understand how a victim has been injured thus helping in the reconstruction of events that would have led to death<sup>2</sup>. In court, several expert witnesses maybe called to give their opinion on whether the injuries are consistent with the explanations offered and with the alleged timing of the events. The age of the bruise is then deduced from photographs of the injuries taken at that time. Published reports on the aging of bruises from their colour are very confusing and various standard textbooks follow different schools of thought. Hence the present study was conducted with the aim of

documenting the colour changes observed in bruises along with their histomorphological appearance.

## MATERIALS AND METHODS:

Institutional ethical committee clearance was obtained before the commencement of the study. The study was conducted in two settings. The bodies were examined and the materials were collected from the deceased persons brought for autopsy to the mortuary, in Dept of Forensic Medicine, Government Medical College, Thiruvananthapuram. The processing of the tissues, staining and the formation of the opinion was done with the help of pathologist, in the Department Of Pathology, Medical College, Thiruvananthapuram.

Eighty medico-legal cases were examined. Both male and female patients with known history and timing of injury were included. Only the contusions of skin,

subcutaneous tissues and those of scalp were included in the study. Bodies without proper history of traumatic incident, decomposed bodies and unknown bodies were excluded from the study. Contusions were classified into three groups of small (both dimensions < 5cm), medium (in between 5x5cm & 10x10cm) and large (above 10cm). Tissue bits of approximate 2.5x2.5x1cm was taken from the site of contusion and fixed in 10% formalin. Slides were prepared with the help of Pathology Department. Routine staining procedure using haematoxylin & eosin stains and the special stains for haemosiderin (Perl's Prussian blue stain) were done. Since there is no confirmatory test to differentiate between haematoidin and bilirubin, special staining techniques were not included.

**RESULTS**

Sixty five male and fifteen female patients were included in the study. The maximum number of cases belonged to persons in their first two decades of life. Of the eighty cases taken, 42% of subjects died within 24 hours of injury. The next order of frequency was deaths occurring on the third day. Road traffic accidents played a major role in causing contusions on various parts of the body. Of the contusions 61% belonged to the medium sized group, 23% to large and 15% to small sized contusions. Regarding the colour of injuries the red contusions dominated

(41.3%) followed by bluish black ones (28.8%). [Table: 1]

**Table 1: Frequency of distribution of colour changes of contusions**

Colour of Injury	Frequency	Percentage
Red	33	41.3
Blue	12	15.0
Bluish Black	23	28.8
Green	7	8.8
Yellow	3	3.8
Others*	2	2.5
Total	80	100

\*Others included bluish green discolouration with intervening pale yellow areas

1. In people who died within 24hrs of injury the colour of the contusion was red (100%).
2. Of the seven cases that died on the second day 85.7% were blue in colour and 14.3% were bluish black.
3. Blue in 50% of cases who died on the third day, 40% it was bluish black & 10 % had greenish tinge.
4. 83.3% were bluish black in those who survived for five days & 16.7% were green in appearance.
5. All cases of six day old was bluish black in colour
6. Seven day old was green in colour. [Table: 2]

**Table 2: Comparison of colour of injury and survival period**

Survival Period	Cases	Red		Blue		Bluish Black		Green		Yellow		Others*	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
< 24 hours	33	33	100										
2 <sup>nd</sup> day	7			6	85.7	1	14.3						
3 <sup>rd</sup> day	10			5		4	40.0	1	10				
4 <sup>th</sup> day	8					8	100						
5 <sup>th</sup> day	6					5	83.3	1	16.7				
6 <sup>th</sup> day	2					2	100						
7 <sup>th</sup> day	1							1	100				
8 <sup>th</sup> day	1			1	100								
9 <sup>th</sup> day	4					2	50	1	25			1	25
10 <sup>th</sup> day	2							2	100				
>10 days	6					1	16.7	1	16.7	3	50	1	16.7
<b>Total</b>	80	33		12		23		7		3		2	

\*Bluish green discolouration with intervening yellow area

Regarding the microscopic examination it was noted that RBCs were present in 77 cases, polymorphs in 28 cases, lymphocytes in 11 cases, macrophages in 30cases and pigments in 22 cases.

Comparative study of microscopic appearances of contusions with the survival period was done. It was found that the RBCs were present in all cases, with the maximum amount seen in injuries within 24 hrs and minimum amount in injuries within 7 to 8 days. Polymorphs were more in number in injuries within 24

hrs and less in second and third day and then again increased on the fourth day. Lymphocytes and macrophages were seen maximum on the third and fourth day of injury and pigments were seen maximum on the fifth day of injury [Table: 3]. Perl's stain was positive in 15% of cases studied. Maximum Perl's positive were noted where death occurred on fifth day (66.7%) followed by death on sixth day (50%) [Table: 4].

**Table 3: Comparative study of microscopic appearance of contusions with survival period**

Survival Period	Cases	RBCs		Polymorphs		Lymphocytes		Macrophages		Pigments	
		No.	%	No.	%	No.	%	No.	%	No.	%
< 24 hours	33	32	96.96	7	21.21	1	3.03	5	15.5	3	9.09
2 <sup>nd</sup> day	7	7	100	4	57.1	-	-	1	14.2	1	14.2
3 <sup>rd</sup> day	10	10	100	4	40	4	40	4	40	4	40
4 <sup>th</sup> day	8	8	100	5	62.5	4	50	6	75	4	50
5 <sup>th</sup> day	6	6	100	3	50	1	16.6	6	100	5	83.3
6 <sup>th</sup> day	2	2	100	-	-	-	-	2	100	1	50.0
7 <sup>th</sup> day	1	1	100	-	-	-	-	-	-	-	-
8 <sup>th</sup> day	1	1	100	-	-	1	100	-	-	-	-
9 <sup>th</sup> day	4	3	75	2	50	-	-	3	75	2	50
10 <sup>th</sup> day	2	1	50	-	-	-	-	2	100	2	100
>10 days	6	6	100	-	-	-	-	1	16.6	-	-
<b>Total</b>	<b>80</b>	<b>77</b>		<b>25</b>		<b>11</b>		<b>30</b>		<b>22</b>	

**Table 4: Frequency of Perl's positive cases and their relation to survival period**

Survival period	Cases	No. of Perl's positive cases (%)
< 24 hours	33	1 (3.03)
2 <sup>nd</sup> day	7	-
3 <sup>rd</sup> day	10	2 (20)
4 <sup>th</sup> day	8	2 (25)
5 <sup>th</sup> day	6	4 (66.7)
6 <sup>th</sup> day	2	1 (50)
7 <sup>th</sup> day	1	-
8 <sup>th</sup> day	1	-
9 <sup>th</sup> day	4	1 (25)
10 <sup>th</sup> day	2	1 (50)
>10 days	6	-
<b>Total</b>	<b>80</b>	<b>12</b>

**DISCUSSION**

It was noted that the medium sized contusions obeyed the normal pattern of healing and was consistent with observations made by Mukherjee <sup>1</sup>. The various shades of colour and their sequence of appearance noted in the contusions of the present study was well in accordance with those described by the renowned authors like Mukherje, Modi, Taylor, Reddy, Gradwohl, Parikh <sup>1-6</sup>.

**Colour of injury and survival period:** In all cases where death occurred in 24 hrs of injury the contusions were red in colour, supporting the view expressed by Bernard knight <sup>7</sup> that no visible changes occur in that time but according to Sydney smith and Francis E Camps a fresh contusion is purple or black in colour <sup>8,9</sup>. This could be due to deoxygenating of blood dominating at the time of sustaining the injury. This was not observed in the present study which could be due to the darker skin shade of the study population. Colour of second and third day old contusions tally with the observations expressed by Mukherje, Reddy, Modi & Gordon <sup>1,2,3,10</sup>. All four day old contusions were bluish black in the present study. Mukherje, Reddy and Parikh opine that once the bluish black colour sets in it

can remain till the fourth day and the next colour change begins on the fifth day only <sup>1,2,4</sup>.

In the cases in which death occurred on the fifth day, 16.7 % were green in colour obeying the general rule expressed by Mukherjee, Modi, Reddy <sup>1,2,3</sup> but 83.3% remained as bluish black. The persistence of this colour could be explained by the large size of the contusions and consequent delayed healing due to associated injuries of vital parts producing a shock like state. In the present study, green colour of contusion sets in only on the seventh day this is in agreement with various authors <sup>1,4,5,11,12</sup>.

After 10 days the colour of contusions was yellow in 50 % of the cases, quite typical of the pattern in normal healing process. According to Mukherjee and Sydney Smith yellow colour can develop in 7 to 10 days. Observations of the present study tally with the upper limit of this period. Hence it was noted that delay in the healing process can result in persistence of the bluish black and green colour in contusions mainly those which belong to large group of contusions.

**Microscopic study:**

In the cases studied, microscopic examination revealed RBCs in 96.3% of cases. Mukherjee states that maximum extravasation of RBC occur immediately after injury <sup>1</sup>. RBCs could be detected even after 10days of survival in the present study. According to Mukherjee RBCS can remain up to 120 days.

Polymorphs can occur as early as thirty minutes and can remain up to a variable period <sup>1</sup>. In the present study polymorphs could be detected only up to five days. In two cases polymorphs could be seen up to the ninth day of survival. In those two cases the victims were above 70 yrs of age. This may explain the delay in disappearance of polymorphs due to delayed process of healing.

Maximum concentration of the lymphocytes is seen after 48 hrs and remains as such for days and then gradually declines. Macrophages were noted in increased number from the fourth day onwards. This is in accordance with the view expressed by Mukherjee

that macrophages will not appear before three days but Moritz says that haemosiderin in phagocytes may be seen after 24 hrs<sup>13</sup>. In 16.7% of cases of this study macrophages appeared within 24 hrs. This may be due to the quicker process of healing expected in younger individuals. The bluish black colour which appeared on the 3 day and remained till the 5 day is due to higher concentration of hemosiderin. The findings of the present study tally with the view that the maximum concentration of pigments is noted in 3 to 5 day old contusions supporting Mukherjee's observation that pigments are seen in 3 day old contusions and it can remain in reticuloendothelial cells for variable periods<sup>1</sup>. 66.7% of Perl's stain positive contusions were five day old which is consistent with the colour of the contusions. The negative Perl's stain is due to the presence of other pigments which do not contain iron in the ferric state i.e. hematoidin or bilirubin. No methods were employed to detect the presence of bile pigments in the present study.

### CONCLUSION:

Based on the present work, in which the histomorphological changes that occur in a contusion with the passage of time were studied in detail, the following conclusions could be derived at:

The observations of colour tone of injury and histopathological findings including special staining techniques like Perl's stain can help the forensic pathologist to a great extent in dating the age of a medium sized contusion in moderately nourished adult subjects during the initial phases of injury.

The colour changes occurring in a medium sized contusion followed a general pattern, for a period within 24 hrs of infliction the contusion was red in colour and by the second day it turned blue. During the next three days it remained as bluish black due to the presence of the pigment, haemosiderin. By five to seven days time, it turned green and by tenth day it became yellow. Purple colour of a recent contusion was not observed in the present study. The histopathological changes that occur in a contusion, as days pass by, followed a more or less similar fashion as described in literature. RBCs appeared as early as 24 hrs of injury and remained up to any day. Polymorphs were predominant during the initial phase of injury, appearing as early as within 24 hrs and remained for

next five days. After that period absence of the cell was a noticeable feature. Lymphocytes were not seen before 48hrs of injury. Macrophages did not appear before three days of injury. Appearances of pigments tallied with the bluish black colour of contusions and maximum number of cases were five days old. In older age groups and in cases with polytrauma, the healing of contusion was delayed. So the age of the subjects and the presence of associated injuries do play a crucial role in the healing process of injuries.

The present study has helped in reaching a conclusion regarding the aging process of contusion supporting the views observed by various authors especially Dr. J. B. Mukherjee.

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