LEVEL OF MONOCYTE CHEMOATTRACTANT PROTEIN-1 (MCP-1) AND PATTERN OF INJURIES IN POLYTRAUMA PATIENTS

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ABSTRACT

Introduction: **Trauma and trauma-related injuries are rife worldwide and constitutes part of the most common cause of hospital admission. Monocyte Chemoattractant Protein-1 is produced by several array of cells in acute traumatic injury and tissue repair.**

Materials and Method: **This research is a prospective hospital-based study carried out at a tertiary hospital in south western Nigeria. Patients admitted through the Emergency department were categorized based on the inclusion criteria. Those eligible for inclusion were recruited and had their blood samples taken into an endotoxin free test tube at 48 +/- 2 hours after trauma. MCP-1 levels in the serum was estimated though the Human MCP-1 ELISA kit. This process was carried out using the ELISA technique based on the manufacturer's guide.**

Results: **The samples of 110 patients were analyzed, patient with the highest combination of injury had injuries to the Head and Neck, Face, chest, Abdomen, Extremity fractures and skin with MCP-1 value of 463pg/ml. The test of relationship using the F-test (0.299), and P-value (1.000) does not demonstrate any correlation between patterns of injury to MCP-1 values in polytrauma patients.**

Conclusion: **The study showed no significant relationship between the patterns of injury in polytrauma patients with serum MCP-1 levels. Therefore, injury pattern cannot be used to predict MCP-1 levels**

Keywords: Polytrauma, Fractures, Pattern of injury, MCP-1

INTRODUCTION.

Injuries to numerous organ systems, at least one of which poses a threat to life, are referred to as polytrauma.[1] The most frequent reason for admission to the hospital includes trauma and trauma-related injuries worldwide. Male adults have a higher prevalence of polytrauma and the deaths that emanate from it, in part because of their adaptability and participation in risky behavioral patterns.[2,3]

A family of chemokines known as monocyte chemoattractant protein includes at least four members: MCP-1, MCP-2, MCP-3, and MCP-4. On chromosome 17, the human MCP-1 structure was originally discovered in 1997. (Chr.17, q11.2). It is 13KDa in size and it is made up of 76 amino acids.[4] Numerous types of cells, including endothelial, fibroblast, epithelial, smooth muscle, and astrocytic cells, are known to elaborate monocyte chemoattractant protein-1 following trauma as part of the body's response for survival. The polymorphonuclear cells play a key role in the chain of events, followed by the monocyte.[5,6,7] Initiating tissue repair through a series of coordinated steps, the body mounts an immune response involving both innate (MCP-1 and other inflammatory chemokines) and adaptive immunity types. In addition, blood levels of innate humoral factors like IL-6 and IL-8 increase as a result of tissue injury. This increase in patients with multiple injuries is really significant.[7,8] There is evidence to support the claim that after injury, MCP-1 levels rise in the body and the maximum expression was observed between 12 hours and 48 hours.[9,10] Different organ systems of the body have different inflammatory mediators, and after brain injury, an increase in MCP-1 has also been noted.[11,12]

Whilst the role of MCP-1 in inflammatory processes has been established by previous studies, this study seeks to explore further any relationship between MCP-1 and various pattern of injuries in the polytraumatized patients.

METHODOLOGY

Study Area

The study was conducted at the University College Hospital (UCH), Ibadan which is a tertiary hospital located in South Western Nigeria. It serves the Ibadan metropolis and also receives referrals from all over

Nigeria. The hospital is utilized by people from all socio-economic classes. From hospital records, the Emergency Department (ED) receives about ten thousand (10,000) patients annually of which 33% are due to trauma.

Study Population

This was a hospital-based prospective study of patients who sustain polytrauma and who presented to the Emergency Department of the Hospital, within a period of one (1) year, between February 2016 and January 2017.

Inclusion Criteria

All patients aged 18 years and above who had polytrauma, that presented to the Emergency department alive for treatment were included, while patient less than 18 years of age, polytrauma patients who were dead at presentation or who died within 48 hours of presentation, or had initial care in another hospital were excluded from the study.

Ethical approval was obtained from the University of Ibadan/University College Hospital Ethical Review Committee (UI/EC/15/0032) and the ethical principles of confidentiality, beneficence, non-maleficence and voluntariness were ensured.

At presentation at the Emergency Department, patients with polytrauma were identified, and the various types of injury sustained were entered into a proforma.

Blood sample was obtained at 48+/-2hours post injury into an endotoxin free test tube. Plasma was separated using a centrifuge and immediately refrigerated at -80^{o}C at the Universal laboratory.

MCP-1 values in the serum was estimated using ELISA technique from samples pooled together and analyzed using Human MCP-1 ELISA Kit in the Chemical Pathology Department Laboratory.

The data collected were screened for error, imputed, and analyzed using IBM SPSS Version 20.0 for Windows (IBM Corp. Released 2011. IBM-SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.).

Descriptive statistics of frequency count and percentages were carried out. Averages, standard deviation, minimum and maximum values were obtained, F-test and line graph were done. Pearson moment correlation were applied at a 5% level of significance.

RESULTS

Table 1: Combined pattern of Injury with MCP-1

Combined pattern of injury	N(freq.)	Mean(pg/ml)	Std. dev.	Min	Max
A,PC,S	1	78.00	78.00	78	78
C,A	2	154.00	15.56	143	165
C,A,EF	1	416.00	416.00	416	416
C,A,S	1	83.00	83.00	83	83
C,EF	2	78.00	12.73	69	87
C,EF,S	2	118.00	9.89.00	111	125
EF,S	18	427.61	685.89	22	2687
F,C,EF,PG	1	132.00	132.00	132	132
F,EF,S	1	214.00	214.00	214	214
F,S	1	21.00	21.00	21	21
HN,A,EF	1	137.00	137.00	137	137
HN,A,PC	1	265.00	265.00	265	265
HN,C	1	124.00	124.00	124	124
HN,C,EF	2	316.00	387.49	42	590
HN,EF	10	199.40	220.57	41	781
HN,EF,PG	1	189.00	189.00	189	189
HN,EF,PG,S	1	109.00	109.00	109	109
HN,EF,S	23	283.17	384.60	28	1664
HN,F	1	45.00	45.00	45	45
HN,F,C,A,EF,S	1	463.00	463.00	463	463
HN,F,C,S	1	131.00	131.00	131	131
HN,F,EF	3	168.00	92.86	101	274
HN,F,EF,S	2	506.50	382.54	236	777
HN,F,S	6	189.167	270.56	18	734
HN,PC,S	1	269.00	269.00	269	269
HN,PG,S	1	947.00	947.00	947	947
HN,S	22	273.18	618.06	10	2841
PC,EF	2	710.50	258.09	528	893

Note: A – Abdominal Injury, C – Chest injury, EF – Extremity fracture
F – Facial injury, HN – Head & neck injury, PC – Pelvic content
PG – Pelvic girdle, S – Skin laceration

Table 2: Pattern of injury, MCP-1 values and their relationships

Combined pattern of injury	N	Mean (pg/ml)	Std dev	95% C.I	Min	Max	F-test	p-value	Remark
							0.299	1.000	p>0.05
A,PC,S	1	78.00	-	-	78	78			
C,A	2	154.00	15.56	14.23 to 293.77	143	165			
C,A,EF	1	416.00	-	-	416	416			
C,A,S	1	83.00	-	-	83	83			
C,EF	2	78.00	12.73	-36.36 to 192.36	69	87			
C,EF,S	2	118.00	9.89	29.06 to 206.94	111	125			
EF,S	18	427.61	685.89	86.52 to 768.70	22	2687			
F,C,EF,PG	1	132.00	-	-	132	132			
F,EF,S	1	214.00	-	-	214	214			
F,S	1	21.00	-	-	21	21			
HN,A,EF	1	137.00	-	-	137	137			
HN,A,PC	1	265.00	-	-	265	265			
HN,C	1	124.00	-	-	124	124			
HN,C,EF	2	316.00	387.49	-3165 to 3797.50	42	590			
HN,EF	10	199.40	220.57	41.61 to 357.19	41	781			
HN,EF,PG	1	189.00	-	-	189	189			
HN,EF,PG,S	1	109.00	-	-	109	109			
HN,EF,S	23	283.17	384.60	116.86 to 449.49	28	1664			
HN,F	1	45.00	-	-	45	45			
HN,F,C,A,EF,S	1	463.00	-	-	463	463			
HN,F,C,S	1	131.00	-	-	131	131			
HN,F,EF	3	168.00	92.86	-62.68 to 398.68	101	274			
HN,F,EF,S	2	506.50	382.54	-2930.53 to 3943.53	236	777			

There is no significant difference in the pattern of injury in relation to MCP-1 values as shown above.

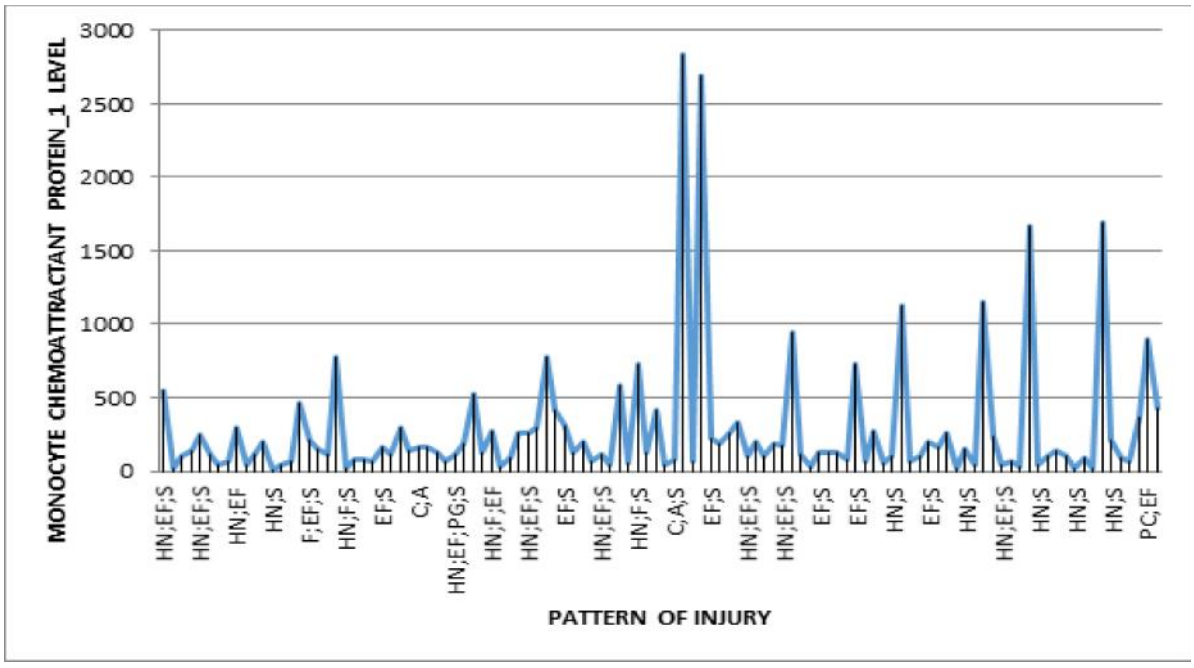

Figure 1. Line Graph showing the Monocyte Chemoattractant Protein-1 values in Relation to pattern of injury

DISCUSSION

Many cell lines in the body release monocyte chemoattractant protein-1 in response to acute-phase reactions to tissue injury.[5] In this study, we try to explore the possibility of any relationship in serum level of MCP-1 and the various pattern of injury sustained in polytrauma patients. Similar to findings in previous

studies, injury combination involving the skin, extremities, head and neck were the most frequent and this was closely followed by patients with skin, head and neck injuries.[13] Also in a study done by Oboirien et al, the common injury combination observed in patients were head and extremity 39%, head and facial 27.4%, head, extremity and facial 27.4%, while head and chest was 11.9%.[14] The patient with the highest combination of injury had injuries to the Head and Neck, Face, chest, Abdomen, Extremity fractures and skin, however, the MCP-1 value of only 463pg/ml (Table 1). Based on the MCP-1 assayed, patients with injury to the pelvic content and extremity fractures had the highest average value of 705.5pg/ml, closely followed by patients with head and neck, facial wounds, extremity fractures and skin injury with MCP-1 value of 506.5pg/ml. Extremity fractures and skin injury had MCP-1 value of 427.6pg/ml and patients with blunt chest injury, blunt abdominal injury and extremity fractures had MCP-1 average value of 416.0pg/ml (Table1). MCP-1 regulates the recruitment of monocytes, basophils, TGF, and other chemical agents at different stages of inflammation.[15,16] Animal studies have shown that MCP-1 levels in plasma can be independently raised during an inflammatory process driven by acute-phase proteins such as IL-1, IL-6, and TNF following trauma. Although no risk stratification was performed for the individuals in this investigation, the existence of additional co-morbidities could have altered serum levels of MCP-1 per time.[12] Chronic inflammatory disorders such as atherosclerosis, diabetes mellitus, and glomerulonephritides among others, have been linked to an increase in MCP-1 serum levels. This documented evidence has created a basis to expect a significant influence on polytrauma patients with these comorbidities.[17-20] Also, an in vivo study revealed that physiologic concentrations of estradiol suppress MCP-1 expression in rabbit, thus, the circulating MCP-1 levels may be influenced by sex hormones.[1] Though translation of in vitro findings to clinical outcomes is often elusive, in vitro studies in hepatocytes showed that trauma/hemorrhagic shock survivors with elevated early levels of plasma MCP-1 post-injury had longer total lengths of stay, longer intensive care unit lengths of stay, and prolonged requirement for mechanical ventilation versus those with low plasma MCP-1.[21,22]

Finding in this study demonstrated no statistical significance in the test to demonstrate the relationship between pattern of injury to MCP-1 values (F-test was 0.299, P-value was 1.000) in polytrauma patients (Table2).The line graph (Figure 1) depicts a discordance between MCP-1 values and pattern of injury therefore, certain injury pattern/ combinations cannot be used to predict MCP-1 levels.

LIMITATIONS

The small sample size of patients owing to the cost of MCP-1 ELISA kit in a poor resource setting

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