ISSN: 2755-015X

Journal of Surgery & Anesthesia Research

SCIENTIFIC Research and Community

Research Article

Open Access

Low Serum Albumin is A Significant Prognostic Factor in Burn Mortality; A Retrospective Study from January 2016 – November 2020 in Buth Jos Nigeria

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ABSTRACT

Introduction: Albumin is a single polypeptide chain of 585 amino acids synthesized by the liver which accounts for 75-80% Osmotic pressure. Hypo albuminemia in burns occurs due to loss from damage tissues, reduction in hepatic blood and due to inhibitory tissue factor such as Necrotic tissue factor, interleukin 1 and 6 released at burn sites.

Method: The information about the 73 patients in our study was from our unit records and the hospital records. We Used the Cobas C III system, colorimetric assay method to carry out the serum albumin and total protein investigations.

Result: We had 11 burn mortality out of the 73 patients, and based on the serum albumin at the time of death, those with serum albumin of < 25g/L have burn mortality sensitivity of 90.9% and specificity of 83.3%.

Discussion: Amongst all the prognostic factors we evaluated such as type, size of burns, age of patients, inhalational injury, co-morbid factors, we found that serum albumin of < 25g/L to be a more useful prognostic factor in burn mortality.

Conclusion: We used serum albumin of < 25g/L in our patients to prognosticate burn mortality and to use this knowledge to optimize their serum albumin to avert death.

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Received: July 27, 2021; **Accepted:** July 31, 2021; **Published:** August 12, 2021

Keywords: Low Serum Albumin, Prognostic factor, Burn Mortality

Introduction

Albumin is a single polypeptide chain of 585 amino acids and organized into 3 functional domains, stabilized by intrachain disulfide bonds. It is a major plasma protein and constitute 3/5th of total plasma protein by weight (3.4-4.7g/dL) which amounts to 25% of total protein synthesized in the liver.

Out of the 12g of albumin per day synthesized by the liver 40% is in body circulation and provides 75-80% of plasma osmotic pressure. It facilitates the transit of fatty acids, steroid, hormones, numerous ligands and drugs such as sulfonamides, penicillin G, dicumarol and aspirin [1].

The skin is the major site for extravascular albumin storage and is the major exchangeable albumin pool needed to maintain plasma levels. Hypoalbuminemia results from direct losses of albumin from tissue damage, from compromised hepatic blood flow due to volume loss, and from inhibitory tissue factors (e.g., Tumor necrosis factor, interleukin – 1, interleukin - 6) released at the burn sites [2].

Burns that exceeds 15% of Total body surface area (TBSA) usually manifest with systemic effects that persist till wound heals [3].

Patients with albumin levels < 2g/dL has a mortality risk of > 80% with 8.4% sensitivity and 83% specificity.

At admission, the albumin level could be used as a sensitive and specific marker of burn severity and an indicator of mortality [4].

In our study we correlated the relationship of levels of serum albumin in burn patients from admission to discharge with the length of hospital (morbidity) stay and mortality.

Method

The information about the 73 patients and their Serum Albumin and total protein investigation results from admission to discharge or demise where provided by the hospital records and plastic surgery unit patient records from January 2016 – November, 2020.

We monitor the progress of our patients using regular serum albumin, comparing it with length of hospital stay in weeks, and mortality.

Using the Cobas C III system we carried out the Albumin and total protein Colorimetric assay:
At a PH value of 4.1, albumin displays a sufficiently cationic character to be able to bind with bromocresol green (BCG), an anionic dye, to form a blue-green complex. The color intensity of the blue-greencolor is directly proportional to the albumin concentration in the sample and is measured photo metrically in gram per deciliter.

Result

We conducted serum Albumin and total protein assay of the 73 burn patients in our study among other investigations. We recorded 11 deaths, 7 where children and 4 where adults with various degree and types of burns. 92.2% of the patients had a hospital stay of 1-4 weeks while 7.8% of the patients had a hospital stay of 4.1 weeks to 77.8 weeks (illustrated in Fig.2 showing an inverse relationship of serum albumin and length of hospital stay).

Based on the serum Albumin at the time of death, those with albumin of < 25g/L have burn mortality sensitivity of 90.9% and specificity of 83.3%.

The length of hospital stay of the 62 burn patients that did not die are variable depending on type of burns, parts of the body affected and whether there is inhalational injury or first interventionist was a doctor or not.

58 patients were managed within 6 weeks before discharged while 4 patients stayed on admission for greater than 6 weeks. 2 out of the 4 patient that stay longest had high tension electric burn of 40% to 90% and the other 2 had flame burns of 14-26%.

Figure 1: Burn Data from January 2016 to November 2020 in Bhuth

S/N	NAME OF PATIENT	AGE	SEX	HOSPITAL NUMBER	DIAGNOSIS	OPERATION	DAYS ON ADMISSION	SERUM ALBUMIN & TOTAL PROTEIN					
		MONTHS/ YEARS						1ST WEEK		2ND WEEK		3RD WEEK	
								AL (g/L)	TP (g/L)	AL (g/L)	TP (g/L)	AL (g/L)	TP (g/L)
1.	T.T.	12	M	037736	27% SCALD	DEBRIDEMENT	15	28	50	-	-	-	-
2.	O.N.	2	M	038410	13% SCALD	DEBRIDEMENT	10	29	41	-	-	-	-
3.	D.D.	12	M	039382	ELECTRICAL BURN	DEBRIDEMENT	15	45	51	22	31	-	-
4.	I.A.	4	M	051379	25% SCALD TR, UL, LL	DEBRIDEMENT	15	26	40	-	-	-	-
5.	L.L.	16/12	M	037426	8% SCALD LL	DEBRIDEMENT	7 (SAMA)	41	62				
6.	E.A.	21/2	F	050796	22% SCALD TR, RLL	DEBRIDEMENT	39	14	29	24	43	-	-
7.	L.M.	4	F	053257	18% SCALD LL, RUL	DEBRIDEMENT	7	33	53	-	-	-	-
8.	Z.M.	6/12	M	053258	10% SCALD	DEBRIDEMENT	23	34	52	-	-	-	-
9.	D.V.	2	M	053619	38% SCALD TR, UL, LL	DEBRIDEMENT	5 (DIED)	19	43	17	31		
10.	L.G.	14/12	F	053826	33% SCALD	DEBRIDEMENT	1 (DIED)	21	46	-	-	-	-
11.	L.D.	8	F	054363	94% FLAME BURNS ENTIRE BODY	DEBRIDEMENT	6 (DIED)	17	42	-	-	-	-
12.	A.D.M.	6	F	054699	24% SCALD UL, LL, TR	DEBRIDEMENT	21	38	72	25	61	-	-
13.	I.N.	1	M	043265	10% SCALD LL & RUL	DEBRIDEMENT	20	34	55	28	47	-	-
14.	U.D.	13	F	082436	9% SCALD	DEBRIDEMENT	5	33	64	-	-	-	-
15.	K.D.	5	M	083036	12% SCALD LL	DEBRIDEMENT	26	37	67	24	53	21	51
16.	N.D.D.	8/12	M	083989	7% SCALD TR, LLL	DEBRIDEMENT	1 (SAMA)	46	62	-	-	-	-
17.	A.H.	5	F	084286	10% FLAME BURNS TR, UL, LL	DEBRIDEMENT	27	31	65	22	55	-	-
18.	C.N.	8/12	F	087810	10% SCALD F	DEBRIDEMENT	15	33	58	-	-	-	-
19.	D.E.	18/12	M	088966	30% SCALD	DEBRIDEMENT	4 (DIED)	30	43	16	26	-	-
20.	S.D.	2	F	087086	40% BURNS	DEBRIDEMENT	17	28	69	24	43	-	-

21.	A.M.	11	F	089447	20% SCALD TR, BU, LL	DEBRIDEMENT	14	38	64	28	57	-	-
22.	C.A.	5/12	F	077391	10% FACIAL SCALD F	DEBRIDEMENT	14	38	67	33	51	-	-
23.	M.V.	1	M	090852	10% SCALD UL & F	DEBRIDEMENT	5	42	50	-	-	-	-
24.	K.E.	7	F	091022	15% SCALD TR, LL	DEBRIDEMENT	3 (SAMA)	50	58	-	-	-	-
25.	M.Z.	6	M	091294	21% FLAME BURNS UL, LL	DEBRIDEMNT	7	41	73	-	-	-	-
26.	S.A.	9/12	M	088951	7% SCALD F, UL, LL	DEBRIDEMENT	7	35	60	-	-	-	-
27.	K.J.	20	M		40% ELECTRICAL BURNS F, TR, UL & LL	DEBRIDEMENT	545 (DIED)	22	46	22	60	21	52
28	M.H.	13	M	092197	78% FLAME BURNS UL, LL TR	DEBRIDEMENT	1 (DIED)	28	65	-	-	-	-
29	G.M.	4	F	101839	30% SCALD TR, UP, LL	DEBRIDEMENT	4	37	59	-	-	-	-
30	M.P.	6	F	101959	14% SCALD T, UP, LL	DEBRIDEMENT	7	38	49	35	67	-	-
31	B.K.	2	M	102215	10% BURNS	DEBRIDEMENT	22	37	76				
32	O.P.	10	F	108849	13.5% FLAME BURNS TR, TH	DEBRIDEMENT	11	31	51				
33	D.P.	11	F	11954	44% SCALD TR, BOTH LL	DEBRIDEMENT	19	20	50	18	39	12	28
34	A.S.	13	F	11954	44% SCALD GL, BOTH LL	DEBRIDEMENT	13	41	64	33	50	36	68
35	D.N.	43	M	097406	3% SCALD DORSUM RF	DEBRIDEMENT	17	31	71	33	74		
36.	M.A.	11	M		69.5% ELECTRICAL BURNS TR, UP, LL, BUT	ESCHARECTOMY	20 (DIED)	43	76	18	39	25	38
37	J.D.	1 6/12	M	109578	14% SCALD TR, LH	DEBRIDEMENT	10	43	75	30	54		
38	C.C.	1 5/12	F	109549	8% SCALD GL, BOTH F & H	DEBRIDEMENT	7	44	62				
39	R.C.	44	F	035374	25% FLAME BURNS RH, TR & LL	DEBRIDEMENT	33 (SAMA)	33.4	46.6	27	36		
40	B.P.	1 1/12	F	120856	20% SCALD BOTH LL	DEBRIDEMENT	2 (SAMA)	42	63				
41	W.C.	5/12	M	118826	14% FACIAL FLAME BURNS	DEBRIDEMENT SKIN GRAFTING TRACHEOSTOMY	150	37	42	28	56	30	54
42	B.C.B.	< 1	M	113467	14% FLAME BURNS UL, TR, LL	DEBRIDEMENT	29	25.8	30.9	26	43	31	43
43	F.U.	2	F	107874	20.5% SCALD BU & UL	DEBRIDEMENT	24	43	64	22	47	30	59
44	A.C.	28	M	125739	1% FLAME BURNS + MILD INHALATIONAL INJURY NOSTRILS	DEBRIDEMENT	2	42	67				
45	B.I.	34	F	112766	8% FLAME BURNS BOTH UL	DEBRIDEMENT	21	33	74				
46	D.G.	8	F	034572	9% FLAME BURNS LL & TR	DEBRIDEMENT	21	37	66	30	55		
47	O.A.	13	F	128680	76% FLAME BURNS TR, LL, UL, F	DEBRIDEMENT	1 (DIED)	16	35				
48	A.A	60	F	128316	19% SCALD TR, LUL	DEBRIDEMENT	30	18	45	16	53		
49	O.P	37	M	128679	45% FLAME BURNS TR, UL, LL	DEBRIDEMENT	2 (DIED)	39	74	16	43		

50	M.M.	2	F	136084	16% SCALD LL, BU, PR	DEBRIDEMENT	14	46	71				
51	O.C.	6/12	M	136211	10% SCALD LL	DEBRIDEMENT	14	49	68				
52	B.K.	6	F	136656	20% FLAME BURNS ULL, LL, FACE & NECK, TRUNK CANDLE FIRE DISASTER	DEBRIDEMENT TRANSFUSED WITH BLOOD	19	42	59	17	30	37	68
53	M.G.	2 8/12	M	136707	21% SCALD	DEBRIDEMENT	12	33	57	25	38	27	52
54	V.C.	14	F	131165	53% FLAME BURNS H&N TRUNK, UL, LL MILD INHALATIONAL INJURY	DEBRIDEMENT BLOOD TRANSFUSSION	24 (DIED)	21	36	17	38		
55	C.F.	34	F	131167	8% FLAME BURNS RTA BOTH FEET	DEBRIDEMENT	24	34	63				
56	F.D.	10	M	136959	26% FLAME BURNS H&N, TRUNK UL, LL PETROL GENERATOR EXPLOSION	DEBRIDEMENT ALBUMIN & BLOOD TRANSFUSSION	83	33	54	17	28	34	63
57	O.M.	45	F	132042	56% FLAME BURNS, H&N, TRUNK, UL, LL COOKING GAS EXPLOSION	DEBRIDEMENT	6 (DIED)	45	61	24	42		
58	C.P.	39	M	132041	33% FLAME BURNS, H&N, TRUNK, UL, LL COOKING GAS EXPLOSION	DEBRIDEMENT	6 (SAMA)	37	56	34	60		
59	I.N.	1	M	043265	14% SCALD (L) UL, BOTH LL (L>R)	DEBRIDEMENT	18 (SAMA)	34	55	22	45		
60	G.D.O.	10/12	M	137206	9.5% SCALD TK, LL	DEBRIDEMENT	2	41	55	34	56		
61	S.P.	15	M	137227	25% FLAME BURNS FROM BURNING CANDLE (L) FACE, BACK (L) THIGH – INHALATIONAL INJURY	DEBRIDEMENT	21	38	50	24	47	27	55
62	S.M.	17	M	137228	12% FLAME BURNS (L) UL, TK BOTH FEET INHALATIONAL INJURY	DEBRIDEMENT	17	40	59	26	50	29	54
63	A.O.	21	M	133056	29% ELECTRIC BURN, HEAD & NECK, TK (L) LL & (R) UL (R) FOOT	DEBRIDEMENT	17	33	59	11	34		
64	B.I.	18	F	132505	36% FLAME BURNS TK, UL, LL INHALATIONAL INJURY	DEBRIDEMENT	14	35	61	20	39	23	50
65	A.A.	1 6/12	M	126549	8.5 SCALD, NECK, TRUNK & (L) SHOULDER	8.5 SCALD, NECK, TRUNK & (L) SHOULDER	8	42	71	30	54		
66	I.A.	28	M	133656	9% FLAME BURNS (HOT CHARCOAL) TO THE UPPER BACK	DEBRIDEMENT	7	42	71	30	54		
67	A.A.	1 6/12	M	126549	8.5 % SCALD TRUNK, NECK UL	DEBRIDEMENT	7	42	71	30	54		
68	N.S.	17	F	140438	13.5% SCALD THIGHS & BUTTOCKS	DEBRIDEMENT	11	44	69	25	41	37	62

69	A.Y.	17	M	140056	91% ELECTRIC BURN OVER THE BACK	DEBRIDEMENT SKIN GRAFTING	56	31	58	34	71	37	65
70	K.Y.	1	F	138138	18% FLAME BURNS HEAD, UL & LL	DEBRIDEMENT	11	40	56	28	63		
71	M.D.	45	M	140120	0.5% ELECTRIC BURN LEFT CHEEK (FACE)	DEBRIDEMENT	7	40	80				
72	D.M.	2	M	126535	7% SCALD BOTH UL	DEBRIDEMENT	8	40	58				
73	R.H.	2	F	138328	17% SCALD LL, BUTTOCKS GENITALIA	DEBRIDEMENT	29	47	67	12	39	21	40

Abbreviations

H: Head
F: Face
N: Neck
UL: Upper Limbs (Lul Is Left Upper Limbs, Rul Is Right Upper Limbs)
TR: Trunk
SAMA: Sign against Medical Advise
BU: Buttocks
PR: Perineum
LL: Lower Limbs
RF: Right Foot
AL: Albumin
TP: Total Protein

Serum Albumin at the Time of Death
Serum Albumin at the Time of Discharge Or Sama

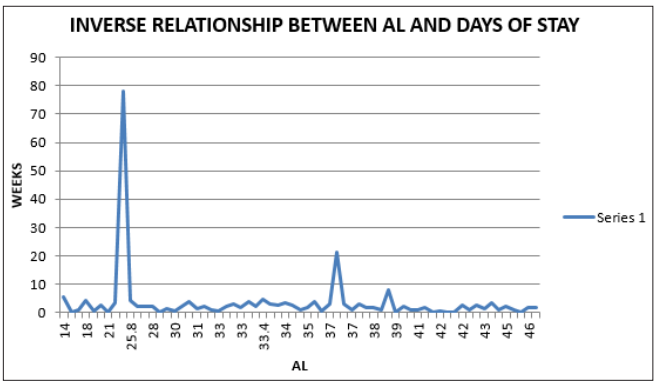

Figure 2

Discussion

We observed numerous factor that have provided prognosis for burn mortality such as presence of inhalational injury, burns in extremes of age (< 10 years or > than 50 years of age), extend and depth of burns, electric and chemical burns, presence of associated injuries such as fractures, spinal injury, splenic injury and presence of co-morbid factors such as diabetes mellitus and chronic renal failure among many factors. We find low serum level of albumin <25g/L at the time of death (with sensitivity of 90.9% and specificity of 83.3% of burn mortality) to be useful as a prognostic factor in burn mortality.

Conclusion

Our study showed us that low level of serum albumin of <25g/L is a significant prognostic factor for burn mortality and has guided us to maintain serum albumin at optimum level to avert death in burn patients.

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