Early Evaluation of Serum Albumin Level in Pediatric Burned Patients

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Abstract

Background: Burn patients are unique in that not only do they reduce albumin synthesis in response to trauma, but also they experience accelerated albumin losses into their wound dressings and soft tissue.

Methods: Serum albumin has been determined in 26 children with age ranged between (l-14) years and with total body surface area of burn (11-60%) during their initial few weeks of care. Their serum albumin levels were estimated at second day, seventh day and fourteenth day after burn. Intravenous albumin was administered by infusion of 1-2 g/kg/d when plasma Albumin fell bellow 2 g/100ml. or bellows 2.5 g/100ml in the presence of enteral feeding intolerance or pulmonary dysfunction, their further results were excluded.

Results: The mean plasma Albumin was 3.062 g/100ml) at day 2 , 2.952 g/100ml at day 7 and 2.45 g/100ml at day 14 . The relationship between the surface area of burn and albumin concentration was not significant, (r = - 0.1111406). The value of albumin was found to be 0.752 g/dl under the normal average value (p< 0.005).

Conclusion: Hypoalbuminemia is usual in pediatric burned patients especially after 7 -14 day of the accident, the period of high risk of septic complications.

Keywords: Serum albumin, Hypoalbuminemia, Burn

ألخلاصة

مقدمه: مرضى الحروق ينفردون ليس فقط بنقصان تكوين الألبومين كاستجابة للشدة ,بل بتسارع فقدان الألبومين إلى ضماد الجروح والانسجه الرخوة.

الطرق: تم دراسة 26 طفلا تراوحت أعمارهم بين (1-14 سنه) والمصابين بحروق مساحتها 11-60% من سطح الجسم خلال الأسابيع الأولى من العلاج .وتم فحص معدلات الألبومين في الدم في اليوم الثاني , السابع والرابع عشر بعد الحرق . أعطي الألبومين الوريدي بجرعة 1-2 غم\كغم \اليوم عندما انخفضت نسبه الألبومين في الدم اقل من 2 غم \100مل ثم تم استبعاد نتائجهم اللاحقة.

النتائج: كان معدل الألبومين للأيام 2, 7, 14 هو 3.06 غم \100مل , 2.296 غم \100مل , و2.45 غم\ 100مل على التوالي. لقد كانت قيمه الألبومين اقل من المعدل الطبيعي بمقدار 0.752 غم \100مل (P≤0,005)

الاستنتاج: استنتجنا من هذه الدراسة بان انخفاض مستوى الألبومين الدم يحدث عاده عند الأطفال المصابين بالحرق خصوصا في اليوم السابع و الرابع عشر ومع بداية الاختلاطات الخمجيه.

Introduction

Laboratory examination of the body fluids serves an important role in managing acutely injured patients. Rapid fluid shifts, changes in composition of administered fluids, and changes in pulmonary function are common in pediatric burned patients. To prevent adverse sequelae from

developing as a result of critical homeostatic derangements, laboratory determinations are often ordered at specified intervals [1].

A prospective randomized trial was performed to determine the early changes in the level of serum albumin in burned pediatric patients.

Although serum albumin has many important physiologic functions, including binding and transport of cations, trace metals, free fatty acids, hormones, and other lipophilic substances and accounts for up to 75% of normal colloid oncotic pressure [1,2] its hepatic synthesis is routinely depressed in response to severe injury, presumably to allow for the increased production of acute phase proteins [3,4].

The consequences of the resulting hypoalbuminemia and the need for supplementation have been debated for many years[5-7].

Burn patients are unique in that not only do they reduce albumin synthesis in response to inflammatory cytokines [3,8,9] but also they experience vastly accelerated albumin losses into their wound dressings and soft tissue secondary to diffuse capillary leaks[10-12].

Physiologic hypoalbuminemia (defined as plasma albumin (PL- ALB) of 1 to 2.5 g/100ml) is a component of the injury response[13]. The normal value of serum albumin in children is 3.2 -4.8 g/100 ml [14]. A consensus on the need for albumin supplementation in this setting is lacking.

In 1992 Report L. Sheridan initiate an albumin supplementation protocol that call for albumin infusion (1-2 g/kg/d) when plasma albumin fell below 1g/100ml, or below 1.5 g/100ml in the presence of enteral feeding intolerance or pulmonary dysfunction. The infusion was stopped when plasma albumin reached 2g/100ml[15].

In this report, we describe our experience with 26 consecutive children who had burn and their serum albumin was studied to evaluate the incidence of hypoalbuminemia.

Material and Method

Twenty children consecutively admitted to burn unit in Alsader teaching hospital in Najaf from July 2007 to June 2008, they had an age range between 1-14 years (mean 5.1 years), average weight of 30 ± 2.5 kg (range 10-30 kg), with total burn surface area (11-60%) (Mean 26%) and average full thickness burn size of 20±5% (range 0-60%) of the body surface. 4 patients (15%) died.

The burned children underwent fluid resuscitation according to rations formula (each one ration is equal to % of burn x weight of patient (Kg) this is given inform of Ringer lactate as follows:

. 3 rations during the first 12 hours,
. 2 rations during the next 12 hours.
. 1 ration during the third 12 hours.

Colloids in form of plasma, dextran or haemacele were given after 36 hours according to the haemodynamic state of the patient.

Five children needed wound excision of eschare with immediate biologic closure of resulting wounds. Wound closure was achieved using autograft. Early oral intake was started as long as good appetite was regained; enteral tube feeding was used in two patients with extensive burn, parenteral feeding was not available.

Human albumin 20% low salt content (Biotest pharma gmbtt. Germany) was used in dose of 1g/kg/day for those with serum albumin <2 g/100ml till correction occurred and for patients with pulmonary dysfunction or enteral feeding dysfunction with 2.5g/100ml serum albumin. Then their next results were excluded from the study

Blood samples were taken from burned pediatric patients that have been treated in burn unit in Alsader teaching hospital in Najaf during second day of care, seventh day and fourteenth day of burn.

After withdrawing 2 ml of venous blood, the blood was transferred to clean centrifuge tube and left for several minutes to clot and centrifuged by centrifuge type N.F- 815 for 15 minutes with 2500 r. p.m. 0.01 ml of the separated serum was used for determination of albumin by Rodkey (Bromo Cresol Green dye binding method) using RANDOX kit[16,17].

Data of serum albumin levels are presented as mean ± SD. Differences in mean levels of serum albumin for control group (healthy pediatric) and for burned patients were compared by students t test, assigning highly significant differences at a p value < 0.005.

Control group was taken from 20 healthy children (those attend primary health care center for vaccination) and was compared to burned children.

Results

A total of 26 collection samples were considered abnormal when compared with control group (20 healthy pediatric samples) according to t test.

The results in table (1) show that albumin concentration has been significantly lowered at seventh day and fourteenth day after burn. Mean plasma albumin in second day was 3.06 g/dl and mean plasma albumin in seventh day was 2.95 g/100ml and 2.45 g/100ml in fourteenth day while in control group was 3.8 g/100ml.

Table (1) represents the statistical analysis of serum albumin levels for burned pediatric group and control group. Those results reveals that there was a general decrease in serum albumin levels for burn patient due to the hypoalbuminemia which occur during burn time ($p<0.005$). The results of serum albumin levels show that the low level was found in fourteenth day after burn; Liver function test was performed in most of patients and revealed no significant changes.

Also the C.V% (coeffient of variation) values shown in table (1) show that control group (healthy pediatric group) has a high degree of homogeneity a round the mean values compared with the results of other groups. While the least degree of homogeneity around the mean values were obtained for burned pediatric group after seven days of burn. Fig (1) represents this result.

There was no correlation between burn size and albumin concentration ($r= 0.111406$).

Table 1.statistical data of the samples

Statistics	Healthy group(control group)	D(2) levels	D(7) levels	D(14) levels
X	3.814	3.062	2.952	2.45
S.D	0.537	0.721	0.835	0.89
(C.V%)	14.08	23.55	28.29	30.25
P< 0.005				

X= mean of serum albumin levels (g/100ml)

C.V= coeffient of variation

Discussion

Immediately after injury hepatic albumin production decreases to allow for production of acute phase proteins[3] subsequently, diminished capillary integrity secondary to wound released mediators is seen[21, 22] with accelerated loss of albumin into soft tissues and wounds [10,11,23]. Particularly during burn resuscitation increased intravascular water may also

contribute to decrease serum albumin concentration. The resulting hypoalbuminemia is often profound, with levels as low as 1.2 g/100ml reported in Jehovah's Witness burn patients who refuse blood products [24].

In burn units aggressive colloid supplementation is routine during resuscitation [25].

In our unit the amount of these products is not sufficient that's why we depend on the use of crystalloid more than colloid during the early management.

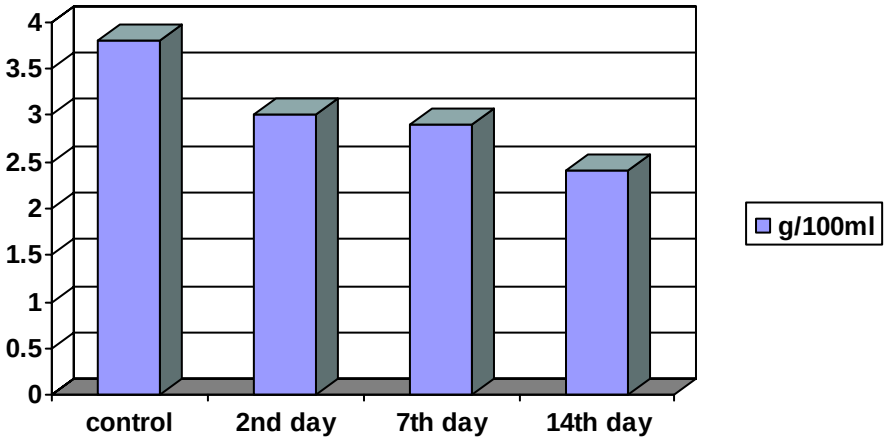

Figure 1 Mean serum albumin level (g/100ml)

The values of albumin were found to be 0.75 g/100ml under the normal average value while Alvarez D. found it to be 1.5 g/100ml below the normal average using Baxter formula [26]. This proves the superiority of using Ration formula in resuscitation regarding albumin concentration. We had also found no correlation between burn size and serum albumin level and this is also found by Alvarez study [26]. This will need further evaluations in the future.

Figure (1) showed significant drop in the albumin concentration over 2, 7 and 14 days and this goes with the progression of the haemodynamic state and the appearance of infectious process which add another trauma on the patient. Because of our difficult circumstances, limited laboratory facilities and poor patient follow up after discharge, the reading of serum albumin during the 14th day after injury were small in no. [13], their mean level was (2.45 g/dl) which is the lowest reading over the burn time (0-14) days and this is the most critical period that many complications could eventually occur, the most dangerous one is septic complications and pulmonary complications, so the period from 3-21 days which is the infectious period should be heavily concentrated on to role out all risk factor in this period. Further study is needed to determine the outcome of this level during the rehabilitation period.

Many studies showed that albumin supplementation to maintain normal serum levels does not seem to be warranted in previously healthy children who suffer sever bums and who receive adequate nutrition[27].

The controlled group gives an idea that our normal children had already established a low level of serum albumin (3.8 g/100ml). This could be due to the state of malnutrition.

Conclusions and Recommendations

Hypoalbuminemia is usual in pediatric burned patients especially after 7-14 day of the accident, the period of high risk of septic complications. The early detection of hypoalbuminemia is essential and the correction of the haemodynamic state should also include the correction of the serum level of albumin. Our children already have low level of serum albumin which add another risk to postburn metabolic complication.

Further studies are required to determine the significance of routine albumin supplement in pediatric burned patients.

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