Original Article

The Pattern of Albumin Consumption in Teaching University Hospitals in Northeastern Iran

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Abstract

Insufficient information on accurate indications of albumin administrations and the lack of acceptable protocols emphasize the importance of performing further studies on the albumin consumption. So, the current study aimed to explore the albumin administration in the teaching hospitals to not only provide an effective pattern, but also to provide low-cost strategies for rational use of this drug. Herein, one hundred patients were given albumin during the study period, who were randomly selected from hospitals affiliated with a large public university. The collected data were analyzed using IBM SPSS Statistics (version 22). Our findings showed that 46% of the patients finally received albumin in terms of the approved guideline. In total, 777 albumin vials were used for 100 cases, for whom 414 vials (53.2%) were rationally prescribed. The albumin was frequently administrated in the ICU wards with 62% of total vials. In accordance with some previous studies, our results demonstrated that most of the albumins were prescribed inappropriately, which impose high-cost on the patients as well as on health care system. Therefore, long-term monitoring of albumin therapy implemented by trained physicians, is suggested to promote rational albumin consumption.

Keywords: albumin, drug utilization review, pharmacy, protocols, teaching hospitals, therapy

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1. Introduction

Drug utilization research as defined by the World Health Organization (WHO) in 1977, has aimed to promote medication care services through drugs marketing, distribution, prescription, and consumption in the society,

with special focus on the medical consequences and social and economic impacts. Thus, the current strategy leads the physician to prescribe a more appropriate drug-based medication [1-3] with the lowest probable cost and dosage [4, 5]. Rational drug utilization is an expertise that needs mandatory information on drug formulation, pharmacoeconomics, pharmacovigilance, *etc*. If rational drug usage and upgraded drug management programs are followed, more people can be appropriately treated [6, 7]. So, consumption pattern of the most expensive medicinal products is of great importance for further investigations [8, 9]. Human serum albumin is an ideal natural colloid with wide clinical utilizations, which is used to restore hypoproteinemia. Nevertheless, indication for albumin administration is a controversial issue due to insufficient proper clinical trials, lack of survival advantages, and rare reports on drug adverse effects [10]. Due to the high amounts of inappropriate albumin use, its limited availability, and its high-cost, it is indispensable to determine its indications on which it is effective [11, 12]. So, this study was planned in order to identify albumin usage pattern in the university-affiliated teaching hospitals, to not only reconsider albumin administration strategies, but also to avoid its ineffectual usage.

2. Materials and Methods

This cross‑sectional study was performed in hospitals affiliated with a large university of medical sciences from March 2018 to March 2019. To do this, one hundred patients in the different wards (CCU, ICU, Emergency, Internal, Pediatric, Burn, and Surgery) who received albumin, were enrolled in this study and then followed up for about one year. Sampling was performed based on the consecutive method. Clinical data were collected in a designed form consisting of three sections. The first part contained patient demographic information, including file number, name, age, gender, admitted ward, admission reason, and concurrent treatments. In the second part, details of the albumin administration were recorded, including albumin consumption reasons, total prescribed dosage, and treatment length. The last section included laboratory results such as serum albumin level, hemoglobin level, liver function tests, renal function tests, electrolytes level, and the received serum, accompanied by the patients' history. Finally, the appropriateness of the albumin administration was checked and then confirmed by a senior clinical pharmacist in terms of the standard guidelines [13, 14]. Subsequently, data were stored and then analyzed with SPSS 22 (SPSS Inc., Chicago). The frequency of both appropriate and inappropriate prescriptions were reported as percentage. The hospital authority approved the study and the anonymity of the patients' clinical data was guaranteed.

3. Results and Discussion

In the current study, a total of 100 patients were enrolled, of whom 65 cases were men. The mean age of the included patients was

51.18 ± 19.8 years old. The patients' demographic as well as characteristics data are listed in Table 1. The total number of 432 (ranged from 1 to 59 vials/patient) and 345 (ranged from 1 to 30 vials/patient) albumin vials were ordered for Imam Reza and Imam

Table 1. Patient demographic data and admission information.

Variables	Results
Age (year, mean ± SD, range)	51.18 ± 19.8 (2-78)
Gender (%)	
Male	65%
Admission ward (the numbers of enrolled patients in different wards) (%)	
ICU	49%
Internal	18%
Burn	10%
Surgery	8%
CCU	4%
Emergency	4%
Pediatrics	4%
Neurology	2%
Heart	1%
Total length of hospitalization (day, Interquartile range)	10 (13.75)
Lab values (mean ± SD)	
Serum creatinine (mg/dL)	1.00 ± 0.90
Serum hemoglobin (g/dL)	12.4 ± 2.13
Na level (mEq/L)	139.24 ± 6.64
K level (mEq/L)	4.09 ± 0.82

Table 2. Details of albumin administrations.

Variables	Results
Albumin level before therapy (g/dL, mean ± SD)	2.16 ± 0.59
Albumin level after therapy (g/dL, mean ± SD)	2.65 ± 0.48
Albumin order (vials/day, Interquartile range)	2 (1)
Total number of vials each patient received during the study (vial, Interquartile range)	6(7)
Duration of albumin therapy (day, Interquartile range)	4(3)
Dosage of Lasix® ampoule (mg/day, Interquartile range)	20 (20)
Duration of Lasix® ampoule administration (day, Interquartile range)	5(3)
Volume of serum administrated (liters/day, Interquartile range)	1(1)
Duration of serum administration (day, Interquartile range)	5(7)

Ali hospitals, respectively. The findings revealed that the duration of albumin therapy ranged from 1 to 30 days. Details of the albumin prescriptions are presented in Table 2. The highest albumin prescriptions were recorded in ICU units in Imam Reza hospital with 270 vials (34.7%) and Imam Ali hospital with 213 vials (27.4%). In terms of the clinical indications, 7.2% of the vials were used for nutritional intervention in Imam Reza hospital , and 18.5% of them were administered for major surgery in Imam Ali hospital (Table 3). A Mann-Whitney U test revealed that higher amount of albumin total costs was spent on an appropriate indication (median [IQR] = 396.43 [308.33] \$) compared to an inappropriate indication (median [IQR] = 220.24 [198.21] \$), U=904.5, p=0.019. This difference was due to the longer duration of albumin therapy in the patients with appropriate indications (median [IQR] = 5 [4] days) than those with inappropriate indications (median [IQR] = 3 [3] days).

Our findings demonstrated that only 23% (179 vials) and 30.2% (235 vials) of total ordered albumins in Imam Reza and Imam Ali hospitals were in concordance with the reliable guidelines, respectively. Among all the

Table 3. Appropriate indications of albumin administrations based on the number of patients and vials.

Indication	Appropriate indications in Imam Reza Hospital		Appropriate indications in Imam Ali Hospital		Total	
	Number of vials (%)	Number of patients (%)	Number of vials (%)	Number of patients (%)	Number of vials (%)	Number of patients (%)
ALI[1]/ARDS[2]	20 (2.6%)	1 (1%)	_____	_____	20 (2.6%)	1 (1%)
Burn	_____	_____	31 (4%)	6 (6%)	31 (4%)	6 (6%)
Cirrhosis	36 (4.6%)	8 (8%)	_____	_____	36 (4.6%)	8 (8%)
Dialysis	31 (4%)	4 (4%)	_____	_____	31 (4%)	4 (4%)
Intracranial Hemorrhage	20 (2.6%)	2 (2%)	55 (7.1%)	4 (4%)	75 (9.7%)	6 (6%)
Major surgery	_____	_____	144 (18.5%)	11 (11%)	144 (18.5%)	11 (11%)
Nephrotic syndrome	16 (2%)	3 (3%)	_____	_____	16 (2%)	3 (3%)
Nutritional intervention	56 (7.2%)	6 (6%)	5 (0.6%)	1 (1%)	61 (7.8%)	7 (7%)
Total	**179 (23%)**	**24 (24%)**	**235 (30.2%)**	**22 (22%)**	**414 (53.2%)**	**46 (46%)**

[1]Acute Lung Injury
[2]Acute Respiratory Distress Syndrome

performed non-compliant albumin therapies with guidelines, 253 (32.6%) out of 432 (55.6%) total administrated vials were inappropriately used in Imam Reza hospital. Besides, 110 (14.2%) out of 345 (44.4%) total administrated vials in Imam Ali hospital had no rational indication. The most common indication for albumin use in Imam Reza hospital was found to be cirrhosis in 8 patients (8%), followed by the nutrition support in 6 cases (6%) and dialysis in 4 subjects (4%). In Imam Ali hospital, the most common indications were major surgery in 11 cases (11%), burns in 6 subjects (6%), and intracranial hemorrhage in 4 patients (4%), respectively. Indications of albumin prescriptions with the related details are presented in Table 3. Of note, changes in albumin levels indicated a significant increase in both Imam Reza (0.69 ± 0.52 g/dL) and Imam Ali hospitals (0.73 ± 0.37 g/dL). The result of the chi-square test showed that there is no considerable association between an significant indication and improvement ($\chi 2=$ 0.865, p= 0.35).

The WHO recommended to apply training activities and monitoring drug policies, to develop rational use of medications and strengthen pharmaceutical management systems [3]. Since albumin administrations increase the mortality rate in patients under critical conditions compared to crystalloid solutions [15], physicians and researchers have focused on prescribing albumin and how to administer it. Subsequently, numerous clinical studies and interventions have been conducted,

and validated guidelines have been published, to improve the therapeutic use of albumin. Despite all these efforts, prescribing and administrating albumin are irrational and inaccurate in many cases [15]. Previous related studies performed in the Iranian teaching hospitals have shown the importance of conducting educational and regulatory interventions in reducing the excessive and illicit use of albumin [16, 17].

Therefore, the current study aimed to reduce the irregular consumption of albumin by designing an albumin request form in compliance with an interactive and collaborative approach among different professionals. In this research, 46% of the cases received albumin in terms of the rational guidelines. The highest appropriate administrations were observed in the patients with major surgery in Imam Ali hospital (11 cases) and those with cirrhosis in Imam Reza hospital (8 cases). Additionally, 414 out of 777 albumin vials (53.2%) had been rationally administered in terms of reliable guidelines. Meanwhile, 363 vials (47%) were inappropriately prescribed.

Comparable investigations in Iranian hospitals obtained similar findings; for example, Jahangard *et al. in their study,* evaluated albumin consumption in 135 patients in Shariati hospital and found that 67.9% of the prescribed albumin had inappropriate indication, and also heart surgery had the most rate of albumin indication [16]. In another study conducted in the teaching hospital in Tehran, albumin

consumption was found to be improper in 52.5% of prescriptions, especially in the hypoalbuminemia cases (23.4%) [18]. Furthermore, a study conducted in Masih Daneshvari hospital demonstrated that 36.2% of patients received albumin irregularly, in a way that there was a direct association between the used vials and mortality rates [19]. According to another study performed on 210 patients in Imam Reza hospital (Tabriz, Iran), 76.2% of cases were prescribed to use albumin inappropriately, and the most inappropriate motives were hypoalbuminemia and nutritional supports [20]. In addition, the justified albumin was prescribed only for 4% of subjects in a Shaheed Rajaei hospital (cardiovascular center, Tehran). In these cases, the leading reason for albumin misapplication was edema (60.8%) [17]. Similarly, the result of a study conducted in the non-teaching hospital in Shiraz (Shahid Motahari hospital) indicated that albumin prescriptions were irrational in 87.3% of patients, and the most common cause of albumin misuse was nephrotic syndrome with no hypoalbuminemia [21]. Meanwhile, albumin has been incorrectly administrated in 52.2% of pediatric cases and 57.8% of adult subjects in 53 institutions, which resulted in financial impacts on the community [22].

Our observations provided evidence that the highest albumin administration based on indications was major surgery (11 cases), and the lowest one was acute lung injury/acute respiratory distress syndrome (ALI/ARDS) (1 patient). In line with our findings, some studies have revealed that albumin is the first-line medication for advanced cirrhosis and its complications [23]. Besides, it is considered an effective pharmacological agent for renal problems [24].

Additionally, our results revealed that the highest number of vials was used in ICU, of which 270 vials were given to 28 patients in Imam Reza hospital, and 213 vials were given to 21 patients admitted at Imam Ali hospital. Among them, 91 vials were prescribed for 17 patients in Imam Reza hospital based on reliable guidelines. As well, 12 patients in Imam Ali hospital rationally received 121 albumin vials. Similarly, in a study performed at the teaching hospital in Tehran (Masih Daneshvari hospital), the most albumin consumption unit was ICU, with 49.3% of total albumin prescriptions [19].

By comparing the results of the first and third phases of the current research, it was revealed that the total number of consumed vials was significantly reduced. It should be noted that in contrast with a significant decrease in the number of albumin administrations in the study, the overall consumption of albumin vials in all three phases showed no steady trend. The amount of the consumed vials in the second stage was 30% lower than the first stage. Despite the fact that the number of prescriptions was decreased by 18% at the third stage compared to the first one, the amounts of vials consumed were increased at this stage. A similar investigation conducted by Ebrahimpour et al. in the teaching hospital in Tehran (Imam Khomeini

University Hospital) demonstrated that albumin duration/dose was decreased by 80% in the third phase [25]. Based on the recommended guideline, usually 10-12 albumin vials (50 ml) are used at each session of plasmapheresis [26]. Accordingly, in this study, the most consumed vials associated with plasmapheresis were observed at the third stage. In contrast, irrational administrations of albumin were significantly decreased for nutritional interventions and edema at the third stage. Although the amounts of albumin prescriptions and administration for hypoalbuminemia were reduced during these three phases, it remained as the second high-consuming indication at the end of study. However, King et al. reported that the amount of albumin used for appropriate indication significantly increased, despite implementing evidence-based guidelines [27].

In our research, serum levels of albumin had not been measured in many patients before and after the administration, which showed that physicians did not consider this issue adequately. So, in the current study, albumin had been administrated not only improperly, but also incorrectly as a first-line remedy in many cases. Several pieces of evidence demonstrate that physicians have not been careful to check albumin serum levels, which probably accounts for the irrational consumption of albumin therapies [21].

4. Conclusion

In conclusion, our observations demonstrated excessive and irregular consumption of albumin in the hospitals affiliated with our university. So, it would be favorable to rationalize albumin administration and reduce the burden of hospital costs by more detailed monitoring of the albumin consumption and clinical practice recommendations in the current hospitals. Nevertheless, more studies are required to determine the albumin patterns in other Iranian health centers, and consider the best approach for albumin usage.

Informed consent

The study's protocol received institutional review board approval and all the participants provided informed consent, which was approved by the Ethics Committee of the North Khorasan University of Medical Sciences (IR.NKUMS.REC.1395.7). Notably, the anonymity of the subjects was guaranteed in this study.

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