

Prevalence of Hospital-Acquired Anaemia in Medical ICU Patients: A Study in a Tertiary Care Hospital, Punjab

Haranjan Kaur¹, Shivani Kalra², Prabhjot Saini³, Vipin Kumar⁴

Abstract

Hospital-Acquired Anaemia (HAA) is very common but underappreciated risk of hospitalisation. Patients admitted with normal haemoglobin who subsequently develop HAA may be at risk for adverse outcomes and it is associated with modifiable factors like blood loss, bleeding, length of stay etc. So, we felt the need to conduct a study which throws a spotlight on the prevalence of HAA and to educate nurses about it. The present study sought to assess the prevalence and contributory factors of HAA and its contributory factors among patients admitted in selected Medical ICUs. It was an exploratory study conducted on 50 critically-ill patients admitted in selected Medical ICUs of a tertiary care hospital, Ludhiana selected by purposive sampling technique. The tool used was Socio-bio-demographic profile, daily record sheet to assess haemoglobin levels as per WHO criteria for HAA (1968) and self-structured tool to explore contributory factors for HAA. Data was collected by self-report method and observation method. The findings revealed that 30 (60%) of the subjects under the study developed HAA among which 70 percent of the subjects had developed mild hospital acquired anaemia and 6.66 percent developed severe HAA. Majority of subjects developing HAA were males (n=23, 76.6%) with mean Hb 12.3±1.21 gm/dl as compared to females 7 (23.3%) with mean Hb 11.39±0.93 gm/dl (p=0.08). There was significant difference in haemoglobin levels from admission till discharge for subjects who developed HAA (13.6 vs 11.2 gm/dl, p=0.00). There was a significant association between the development of HAA and the consumption of nephrotoxic drugs (p=0.05) and PCV values (p=0.00). Significant association of HAA grades with investigational blood loss was observed (p=0.00). Prevalence of HAA among subjects was 60 percent with majority having mild HAA. HAA progresses with longer stay in hospital. There was a significant association of nephrotoxic drugs and reduced PCV with HAA. More the investigational blood loss, more was the severity of HAA.

Key words: Hospital-acquired anaemia, ICU, Investigational blood loss

Hospital-acquired anaemia (HAA) is defined as anaemia that develops during hospitalisation in patients who had normal haemoglobin (Hb) level on admission. Normal haemoglobin (Hb) level for men is considered as <13 gm/dl and for women, <12g/dl. Anaemia can be categorised as Mild (Hb <11.0g/dl), Moderate (Hb 9.1- 11.0g/dl) and Severe (Hb <9.0 g/dl). Anaemia that develops because of hospitalisation has been named hospital-acquired anaemia (HAA). HAA is prevalent among ICU patients and may concern up to 66 percent of patients at admission and almost all patients within the next 72 hours. A recent study indicated that 58.8 percent of patients admitted to ICUs were anaemic, and 21.8 percent required red blood cell transfusions during their hospitalisation. In India, the prevalence of HAA has been reported to range from 30 to 40 percent in tertiary care

settings, with variations based on the region and patient population. It has been observed that haemoglobin levels often drop by 1–2 gm/dl within the first week of ICU admission, primarily due to frequent blood sampling, invasive procedures, and critical illness. Despite the high burden of critically ill patients in tertiary care hospitals, there is a lack of comprehensive data on the prevalence and contributing factors of HAA in Punjab. The study was therefore conducted to assess the prevalence of HAA and to explore the contributory factors of HAA among patients admitted in selected medical ICUs.

Objectives

The study was conducted with following objectives:

1. To assess the prevalence of hospital-acquired anaemia (HAA) among patients admitted in selected Medical ICUs.
2. To explore the contributory factors of HAA among patients admitted in selected Medical ICUs.

The authors are: MSc {N} student; 2. Professor; 3. Principal; 4. Associate Professor, Dept of Medicine; 1 & 4 are at DMCH, Ludhiana, 2 & 3 are at SKSS College of Nursing, Ludhiana (Punjab).

Methodology

An exploratory research design was used to assess the prevalence of hospital acquired anaemia among 50 patients admitted with normal haemoglobin to selected medical ICUs of a tertiary care hospital, Ludhiana. The patients included were those >18 years of age, admitted with normal haemoglobin (Men: 13-17 gm/dl, Women: 12-15 gm/dl) while the patients with any bleeding disorder, post-operative procedures, kidney disorders, haematologic malignancy, normal haemoglobin after repeated blood transfusion, less than 2 days of hospital stay, any trauma or injury and with an autoimmune disorder were excluded from the study. The structured daily record sheet was used to assess record data. The Hb levels were documented daily. Assessment of factors contributing to hospital-acquired anaemia was done by observing records and reports of the subjects. Blood loss volume estimation (sampling/ investigational, insertional, and surgical) was done by observation and interview methods. The patients were followed till discharge. A written informed consent was taken from each subjects/ relative and subject information sheet was provided to them. Anonymity of the patients and confidentiality of information was maintained. The calculation has been done using statistical software SPSS (Statistical Product and Service Solutions 16.0). Significance of effect or difference was established at the level of 0.05 levels. Written permission for conducting study was taken from ethical committee of DMC & Hospital, Ludhiana.

Results

Out of 50 subjects more than half (54%) were in age group above 55 years with the mean age of 54.5 ± 1.88 years; most of them were males, married, belonged to Sikh religion, belonged to urban area and were non-working. As per education of the subjects, equal number of the subjects i.e. 13 (26%) were graduate or above educated whereas only 02 (4%) of the subjects were illiterate. Majority of the study subjects i.e. 31 (62%) were non-working and belonged to urban area (n=29, 58%). As per dietary pattern most of the subjects (52%) were non-vegetarian.

Thirty (60%) patients had hospital-acquired anaemia with mean haemoglobin level of 12.09 ± 1.21 whereas 20 (40%) had no HAA, and mean haemoglobin level of 14.1 ± 1.05 . The mean difference

between HAA present and HAA not present groups was -2.01 ± 0.16 with $p=0.01$, and the difference was found to be significant at $p < 0.05$ (Table 1).

As per the hospital gradation of hospital-acquired anaemia out of 30 patients who had HAA, 21 (70%) subjects had Mild HAA with mean haemoglobin of 12.66 ± 0.71 , 7 (23.33%) had moderate HAA with mean haemoglobin of 11.18 ± 0.58 and 2 (6.66%) had severe HAA with mean haemoglobin of 9.24 ± 1.19 . The difference between the groups has been found to be statistically significant at $p < 0.05$. So, it is concluded that most of the subjects developed mild HAA during their stay in hospital (Table 2).

Among the 30 patients who developed HAA, there was highly significant reduction in haemoglobin levels from admission till discharge at $p < 0.05$ while among 20 (40%) patients who did not develop HAA, and there was no significant reduction in haemoglobin levels from admission till discharge at $p=0.73$ (Table 3).

Table 4 depicts factors leading to blood loss among subjects. Blood investigations were done all 50 subjects and the mean investigational blood loss (in ml) for the subjects who developed HAA was 54.3 ± 40.8 whereas for subjects who did not develop HAA, the mean investigational blood loss (in ml) was 44.42 ± 31.54 with mean difference of 9.88 ± 9.26 and $p=0.36$ at $df=19$ implying no significance of investigational blood loss with development of HAA. Insertion of invasive lines was done for 2 subjects and the blood loss during the procedure was not documented. Surgery was done for one subject who did not develop HAA and the blood loss (in ml) was 100 ± 0.00 . Therefore, blood loss was not related to development of HAA.

Table 1: Prevalence of hospital-acquired anaemia (N=50)

Hospital Acquired Anemia (HAA)	f(%)	Hemoglobin levels (Mean $\pm$ SD)	MD $\pm$ SD	Unpaired t test p value
Present	30(60)	12.09 ± 1.21		$t=-6.04$
Not present	20(40)	14.1 ± 1.05	-2.01 ± 0.16	$p=0.00^*$

*=significant $p < 0.05$, MD=Mean Difference

Table 2: Gradation of hospital acquired anemia (HAA) (N=30)

HAA Gradation (n=30)	f(%)	Hemoglobin levels (Mean $\pm$ SD)	ANOVA
Mild	21(70)	12.66 ± 0.71	$F=28.48$ $p=0.00^*$
Moderate	7(23.33)	11.18 ± 0.58	
Severe	2(6.66)	9.24 ± 1.19	

*=significant $p < 0.05$, *Criteria for Gradation of Hospital Acquired Anemia:

○Mild anemia- Men: 11-12.9 g/dl, Women: 11-11.9 g/dl,

○Moderate anemia- Men: 8-10.9 g/dl, Women: 8-10.9 g/dl and

○Severe anemia- Men: < 8 g/dl, Women: < 8 g/dl

Table 3: Comparison of mean haemoglobin values at admission, at 48 hours and at discharge

Time	HAA					
	Present (n=30)			Not present (n=20)		
	M±SD	MD±SD	t test p value	M±SD	MD±SD	t test p value
Admission (a)	13.6±0.8	1.6±1.14	t=7.65 p=0.00*	14.3±0.9	0.5±1.38	t=1.77 p=0.09 ^{NS}
48 Hours (b)	12±1.32			13.8±1.2		
Discharge (c)	11.2±1.5	0.8±1.39	t=3.07 p=0.00*	14.2±1.1	-0.4±0.7	t=-2.78 p=0.01*

*NS= Non-significant p>0.05. *=significant p<0.05, MD=Mean Difference

Table 4: Factors leading to blood loss among patients (N=50)

Factors	n	Mean blood loss (in ml)		MD±SD t test p value
		HAA		
		Present (n=30) (Mean±SD)	Not Present (n=20) (Mean±SD)	
Blood Investigations	50	54.3±40.8	44.42±31.54	9.88±9.26 t=0.91 p=0.36 ^{NS}
Insertion of invasive lines**	2	-	-	-
Surgery	1	-	100±0.00	-

*NS= Non-significant p>0.05. ** Not documented

Discussion

The present study shows that out of 50 patients, 30 (60%) developed HAA. The present study also reveals that out of 30 subjects who developed HAA, 21 (70%) subjects developed Mild HAA, 7 (23.33%) subjects developed Moderate HAA and only 2 (6.66%) developed Severe HAA. A similar study was conducted by Jamee A et al (2014) to analyse the prevalence of anaemia among cardiac patients, which reported that 181 (60.3%) patients were anaemic and 119 (39.7%) patients were non-anaemic.

Similar results were reported by Balusu (2020) who conducted a study at All India Institute of Medical Sciences (AIIMS), New Delhi, indicated that the prevalence of HAA in ICU patients was approximately 40 percent, with blood loss from frequent sampling and the high incidence of sepsis and inflammation playing significant.

Further, El-Soussi et al (2016) reported that more than three quarter i.e. 76.9 percent of patients developed nosocomial anaemia by day 3. Salisbury et al (2014) also reported that HAA was common i.e. 10,166/17,676 (57.5%) patients developed HAA. Mild HAA developed in 6615 (37.4%), and moderate-to-severe HAA developed in 3551 (20.1%) patients. Similar results were

reported by Gianserra et al (2011) where out of total of 192 patients, 139 (72.4%) were presented with anaemia; 89 of them (46.4%) had it at admission and 50 (26%) developed it during their hospital stay, 47 out of 192 showed a drop in haemoglobin ≥ 2 gm/dl (24.48%). Lower values of haematocrit and haemoglobin were present at discharge (p = 0.01), parenteral hydration at a higher volume (p = 0.01), and lengthier hospitalisations (p =0.0001).

The present study found that the mean investigational blood loss (in ml) for patients who developed Mild anaemia was 41.9 ml, 70.5 ml and 127.5 ml for patients who developed moderate and severe anaemia and occurrence of HAA was highly statistically significant with investigational blood loss at p<0.01 i.e. HAA severity increased as the amount of blood loss increases.

Similar findings were reported by Singh et al (2018), in their study at a tertiary care hospital in Punjab; they reported that around 35 percent of ICU patients developed HAA during their stay, with major contributing factors being the frequency of phlebotomy, inadequate nutrition, and the severity of illness.

Micheal et al (2013) reported that the frequency of blood draws in the ICU has been shown to be a key contributor to HAA, with some studies estimating that up to 20-30 percent of blood loss in ICU patients is due to diagnostic sampling.

The present study also revealed that total 30 of the 50 subjects developed HAA and there was highly significant reduction in haemoglobin levels from admission (Hb=13.6) till discharge (Hb=11.2) with p=0.00; 20 (40%) subjects did not develop HAA and there were no significant reduction haemoglobin levels from admission (Hb=14.3) till discharge (Hb=14.2) with p=0.73.

A similar study was conducted by Kurniali et al (2014) on 479 patients who were admitted to Roger William Medical Center in USA, in which 65 percent of patients dropped their haemoglobin by 1.0 gm/dl or more, and 49 percent i.e. 234 of the 479) patients developed anaemia by discharge. On average, patients dropped their haemoglobin from 13.8 (on admission) to 12.4 gm/dl (on discharge). In another similar study by Koch et al (2011) on prevalence, outcome, and health care implication of hospital-acquired anaemia in 9 community hospitals of Cleveland, Ohio, USA, it was found

that among 1,88,447 hospitalisations 1,39,807 (74%) patients developed mild HAA, 40,828 (29%), 57,184 (41%) developed moderate HAA, and 41,795 (30%) developed severe HAA.

Conclusion

The present study concluded that 60 percent of the patients developed hospital-acquired anaemia among which 70 percent of the subjects had developed mild HAA and 6.66 percent developed severe HAA. There was a significant reduction in haemoglobin levels at 48 hours and till discharge of the subjects who developed HAA ($p < 0.05$). There was highly significant association of HAA grades i.e. mild, moderate and severe with investigational blood loss. Efforts to minimise unnecessary blood draws, implement effective anaemia management protocols, and optimise nutritional support could significantly reduce the prevalence and impact of HAA in ICU patients.

Recommendations

- It is recommended that early detection of hospital-acquired anaemia should be done. A standardised protocol for prevention of HAA should be developed.
- Nursing staff should carefully assess daily haemoglobin levels of all the ICU patients so that timely interventions can be taken to manage this problem in such patients.
- A section in HIS can be added where nurses or laboratory staff can document the amount of investigational blood loss.
- New flow sheet for nurses can be developed to document the amount of investigational blood loss.
- An interventional study can be carried out to identify/assess the effect of specific strategies for prevention of HAA.
- Similar study can be conducted in areas of the hospital other than medical ICUs to find out prevalence of HAA.

- This study can be conducted with a larger sample size and for longer time duration. Based on the findings of the study analytical framework have been developed that can help us to detect and manage the cases of HAA.

Limitations of the Study

- o Limited generalisation of the study as the sample size was small.
- o Study setting was limited to only one tertiary care hospital.
- o The amount of investigational blood loss was written after asking the respective nursing staff attending the patient as the investigational blood loss was not documented anywhere.
- o The inability to detect erythropoietin impairment as erythropoietin level is not requested in the routine investigations.

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अस्पताल-जन्य संक्रमणों से बचाव

क्या आप जानते हैं, अस्पताल में भर्ती 100 मरीजों में से 15 को वे संक्रमण लग जाते हैं तथा संक्रमित होने के बाद 100 में से जीवित नहीं लौटता। यह स्थिति भारत में ही नहीं, समूची दुनिया की है। इन्हें अस्पताल-जनित संक्रमण से भी जाना जाता है। दिलचस्प यह है कि अस्पताल में भरती न होते तो ये संक्रमण कतई न होते; यह भी कि घर में उसी संक्रमण से बचाव दुष्कर नहीं होता। इन जोखिमभरे संक्रमणों में उल्लेखनीय हैं, रक्तप्रवाह संक्रमण (बीएसआई), निमोनिया (जैसे, वेंटिलेटर-संबंधित), मूत्रपथ संक्रमण (यूटीआई) और सर्जिकल साइट संक्रमण (एसएसआई), वायरल, जीवाणु और फंगल संक्रमण।

आरंभ में ही इन संक्रमणों की पहचान कर उचित उपाय अपनाए जाने, रोगी के संपर्क में आते उपकरणों को पूर्णतया कीटाणुरहित रखने और अस्पताल के परिवेश की विशेष साफसफाई से अस्पतालजन्य संक्रमणों पर अंकुश लगेगा।