Research Square

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Association of the PANC-3 Score With Outcomes of Patients Presenting With Acute Pancreatitis

Kipa Shrestha

res.kipashrestha@pahs.edu.np

Province Hospital, Putalibazar

Suraj Rijal

Patan Academy of Health Sciences

Samita Acharya

Patan Academy of Health Sciences

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Abstract

BACKGROUND:

Early recognition of severe acute pancreatitis and intervention can improve outcome of acute pancreatitis. Using three easily available parameters namely serum hematocrit, body mass index (BMI) and pleural effusion on chest X-ray, PANC 3 score predicts severity of acute pancreatitis, ICU (Intensive Care Unit) requirement, mortality and need for early referral. It is easy for triaging and doesn't need complex calculation. With scarce evidence available on its use in Nepal, this study was conducted to evaluate the association of PANC 3 score with outcome of patients with acute pancreatitis.

METHOD:

This cross sectional analytical study was done in patients of acute pancreatitis admitted in Patan Hospital. Outcome of patients was evaluated as in-hospital mortality, ICU admission and duration of hospital stay. The data analysis was done in Easy R software. P-value of < 0.05 was considered statistically significant.

RESULT:

Out of 117 cases, PANC 3 score was < 1 in 67 patients (57.26%) and ≥ 1 in 50 (42.73%) cases. ICU management was required in 6 cases of PANC 3 score < 1 with significant association between ICU requirement and PANC 3 score (p = 0.00016). 5 cases (4.27%) of in-hospital mortality occurred in the group with a PANC 3 score ≥ 1, with a statistically significant p-value (p = 0.029). Duration of hospital stay increased with increased PANC 3 score (p = 0.0003).

CONCLUSION:

PANC 3 score was significantly associated with in-hospital mortality, increased requirement of ICU and longer hospital stay. So, PANC 3 score can be used for predicting outcome of patients.

BACKGROUND

Acute Pancreatitis(AP) is one of the most common causes of acute abdomen presenting to Emergency Department.[1] It is also one of the most frequently encountered gastrointestinal conditions necessitating hospitalization.[2] The age standardized incidence rate of AP globally and in South Asia is 34.8 and 43 per 100,000 population respectively in 2019.[3] The prevalence of acute pancreatitis in a tertiary centre of Nepal was found to be 7.69%.[4] Mortality rate varies with studies done in Nepal ranging from 3.3 to 6.5.[5,6] There are several scoring systems to predict patients at risk for severe acute pancreatitis (SAP) like

Ranson, BISAP, APACHE II, Balthazar score, CT Severity Index (CTSI) that have long been utilized and each has its own limitations.[7] While the complexity of APACHE II scoring system makes it challenging to perform, [7,8] scoring systems such as Balthazar score, CTSI, and modified CTSI do not incorporate clinical variables and offer no significant advantage over clinical scoring systems in predicting severity. Limitation of Ranson and Glasgow scores is that they cannot be fully assessed until at least 48 hours after the onset of illness. [9]

Brown et in 2007 introduced the PANC 3 score to create a prognostic test for severe complications of acute pancreatitis that is quick, precise, and feasible for use in most emergency departments and outpatient clinics. The score uses three variables namely serum hematocrit, body mass index (BMI) and pleural effusion on chest X-ray. A score of 1 is given to each if serum hematocrit was > 44 mg/dl, BMI > 30 kg/m^2, and pleural effusion was detected on the chest X-ray. Combination of all the three variables was highly predictive of SAP. [10] The sensitivity and specificity of PANC 3 score ranges from 50 to 85.4% and 65.2 to 100% and a positive and negative predictive value ranging from 48.8 to 100% and 85.45 to 95.29%.[11–15] Beduschi et al. and Rongpi et al. identified pleural effusion as the most predictive factor, whereas Brown et al. and Fukuda et al. highlighted hematocrit as the strongest predictor in their respective studies. [10,11,15,16] A cut off value of PANC 3 score of less than 1 is found to predict the development of infected pancreatic necrosis, organ failure and mortality. [12] PANC 3 score was found to be as effective as BISAP score and APACHE II score and comparable with modified ATLANTA classification in predicting the severity of pancreatitis.

PANC 3 score is a practical and efficient tool for early triage of patients with AP, enabling timely assessment of disease severity at the time of admission and for deciding further management as well as early referral to higher center. [13,19,20] Its simplicity, requiring no complex calculations or specialized expertise, makes it easy to implement and less time-consuming. Additionally, it is cost-effective, enhancing its accessibility in resource-limited settings. Studies have shown rapid identification of severe AP using the PANC 3 score can facilitate early ICU admission and prompt management, which has been found to be associated with improved patient outcomes and reduced mortality rates.[13,14,16–19] Despite its benefits, there is a notable gap in research in applying the PANC 3 score within the context of Nepal. Studies specific to the Nepalese population are particularly scarce. Most existing studies focus on the score's predictive capabilities while studies validating and assessing its effectiveness in predicting clinical outcomes such as mortality, hospital stay, and ICU requirements are lacking. This marks the rationale for this study as it could provide critical insights into the applicability of the PANC 3 scoring system in local clinical settings and help establish an association of the score with the outcome in acute pancreatitis patients in Nepal.

METHODS

AIM

To evaluate the association of PANC 3 score with outcome of patients presenting with acute pancreatitis.

1. To identify the association of PANC 3 score with in-hospital mortality in patients presenting with acute pancreatitis
2. To identify the association of PANC 3 score with requirement of ICU admission in patients presenting with acute pancreatitis
3. To compare PANC 3 score with length of hospital stay in patients presenting with acute pancreatitis

HYPOTHESIS

1. Null Hypothesis: There is no association between PANC 3 score and outcome of patients presenting with acute pancreatitis
2. Alternate Hypothesis: There is association between PANC 3 score and outcome of patients presenting with acute pancreatitis

STUDY DESIGN

Cross-sectional study (Prospective, analytical, single hospital based)

PLACE OF STUDY

Emergency department, medical, surgical ward, High Dependency Unit (HDU) and Intensive Care Unit (ICU) of Patan Hospital, Nepal

DURATION OF STUDY

12 months

INCLUSION CRITERIA

1. The patients who met the criteria defining Acute Pancreatitis
2. Those who give consent
3. Age > 18 years

EXCLUSION CRITERIA

1. Acute on known case of chronic pancreatitis
2. Known case of cardiac failure, liver failure, and renal failure
3. Presence of pleural effusion preceding development of Acute Pancreatitis,
4. Known case of anemia, polycythemia

5. Known case of pregnancy

DETAIL METHODOLOGY, PROCEDURES FOR REPLICABILITY

Data was collected after the approval of the thesis proposal was received from PAHS-IRC (Institutional Review Committee of Patan Academy of Health Sciences). Data was collected on a structured proforma covering the relevant subjects of the study. It was done twice or thrice a week during lunch break and after 4 pm from Emergency department, medicine ward, surgical ward, HDU and ICU from diagnosed cases of Acute Pancreatitis.

WORKING DEFINITION:

1. Acute Pancreatitis: When there is presence of two of the following three features of: [21]

    1. Characteristic abdominal pain: Acute and persistent epigastric pain often radiating to the back
    2. Elevated serum amylase or lipase more than 3 times the upper limit of normal, and
    3. Characteristic findings on imaging- CT scan, MRI or Ultrasonography

2. PANC 3 score: One score was given for each of the following parameters:

    1. Hematocrit of > 44%,
    2. BMI of > 30 kg/m2 and
    3. Chest Xray that reveals pleural effusion [10]

3. Outcome of patients was evaluated on the basis of following three points:

    1. In hospital mortality
    2. ICU admission and
    3. Duration of hospital stay

The total score was added and classified as below:

Positive score: Total score more than or equal to 1

Negative score: Total score less than 1

PROCEDURAL DETAILS:

1. Upon receiving a case which fulfilled the inclusion criteria and had no exclusion criteria, the patient or nearest kin was explained about the study in detail.
2. They were assured of confidentiality and a written informed consent was taken subsequently. These investigations did not put extra burden to the patients as they were done as a part of routine

evaluation.

3. Hematocrit at the time of admission was traced by using patient Hospital number and noted in the proforma.
4. The BMI of the patient was calculated from weight taken at the time of admission and height while filling the form.
5. For patients who were not able to stand, the supine length of these patients was taken. [22]
6. And for weight, recent last recorded weight was taken if known.
7. Chest Xray taken on the day of admission was looked for the presence of Pleural Effusion and recorded.

SAMPLE SIZE CALCULATION

Sample size of cross sectional study with proportion is

$n = [DEFF*Np(1-p)]/ [(d^2/Z^2_{1-\alpha/2}*(N-1) + p*(1-p)]$

Where n= sample size; deff= design effect; N= population size; p is estimated proportion; q = 1-p and d = desired absolute precision or absolute level of precision

Prevalence of acute pancreatitis from a study done in Nepal was found to be 7.69%. [4]

Population size (for finite population correction factor or fpc)(*N*): 1000000

Hypothesized % frequency of outcome factor in the population (*p*): 7.69%+/-5

Confidence limits as % of 100(absolute +/- %)(*d*): 5%

Design effect (for cluster surveys-*DEFF*): 1

With the confidence level of 95% total sample size is 110 + 10 (10% non responders) = 120

SAMPLING TECHNIQUE

Non probability, convenience sampling

DATA PROCESSING SOFTWARE

Easy R software

STATISTICAL ANALYSIS

1. Data analysis were performed upon completion of the sample size collection.

2. Data were entered in EPI-INFO and was analyzed in Easy R software.
3. Continuous variables (age and duration of hospital stay) was first tested for normality of the data using the Kolmogorov-Smirnov test. The data was then decided to be presented in Mean ± Standard Deviation (SD) if the data was normally distributed. Else if data was skewed, it was expressed in Median ± Interquartile Range. Then continuous variables was presented as Mean ± SD as the data was normally distributed and then it was compared using t test for 2 groups. It was then compared using Man Whitney test as there are 2 groups.
4. Categorical variables (in hospital mortality and requirement of ICU admission) was presented in Number and Percentage (%). The categorical variables were analyzed by chi square test if expected value in each cell was more than 5 or by fisher exact test if any cell has a value less than 5.
5. A P value of < 0.05 was considered statistically significant.

RESULTS

A total of 117 patients of acute pancreatitis were collected who met the inclusion criteria and did not have any exclusion criteria. Age range of the patients was from 18 years to 85 years with the mean age of 46.63 years and standard deviation of 16.19 years (Fig. 1 and Table 1). There were a total of 78 (66.67%) male cases and 39 (33.33%) female cases (Table 1). Out of the total 117 cases, PANC 3 score was found to be negative in 67 (57.26%) patients and positive in 50 (42.73%) patients (Fig. 2).

Table 1
Demographic details of study population and their PANC 3 score. (N = 117)

	PANC 3 score		**P value**
	Negative	**Positive**	
Age (in years)	47.20+/-16.23	45.86+/-16.27	0.658 (2-way t test)
Sex			
Male	41	37	0.209 (Chi-square)
Female	26	13	

There were total of 5 cases (4.27%) of in-hospital mortality in patients with acute pancreatitis and all of them occurred in the positive PANC 3 score group. Comparing the in-hospital mortality with respect to PANC 3 score, p- value was found to be less than 0.05 (Table 2) showing that there is statistically significant association between PANC 3 score and in hospital mortality. Post hoc power was calculated for the association of PANC 3 score and in-hospital mortality and was found to be 46.1%.

Table 2
Association of PANC 3 score with in-hospital mortality in patients presenting with acute pancreatitis (N = 117)

PANC 3 score	In- Hospital Mortality		P-Value (Fisher's exact test)
	Yes	No	
Negative	0	67	0.029
Positive	5	45	

ICU was required in a total of 26 (22.2%) cases among which 6 cases belonged to the negative group and 20 cases belonged to positive score group. P value was found to be 0.00016 which is less than 0.05 (Table 3) proving that there is statistical significance between the requirement of ICU and PANC 3 score in patients with acute pancreatitis.

Table 3
Association of PANC 3 score with requirement of ICU admission in patients presenting with acute pancreatitis (N = 117)

PANC 3 score	ICU Requirement		P-value (Chi- square)
	Yes	No	
Negative	6	61	0.00016
Positive	20	30	

Median duration of hospital stay for negative PANC3 score was 4 days with IQR of 2.5 with minimum stay of 1 day and maximum stay of 26 days (Fig. 3) and for positive PANC 3 score was 6 days with IQR of 5 with minimum stay of 2 days and maximum 24 days (Fig. 4). It was found to be statistically significant with P value of 0.0003 ($P < 0.05$) as shown in Table 4.

Table 4
Association of PANC 3 score with duration of hospital stay in patients presenting with acute pancreatitis (N = 117)

PANC 3 score	**Duration of hospital stay (days)**	**P-value (Mann-Whitney U test)**
Negative	4 ± 2.5 days	0.0003
Positive	6 ± 5 days	

DISCUSSION

This prospective, analytical study found statistically significant association between PANC 3 score and key parameters including in-hospital mortality, ICU admission, and hospital stay duration and hence highlighted the clinical utility of the PANC 3 score as a prognostic indicator. The results of this study are

consistent with majority of international findings that link higher PANC3 scores with mortality, increased ICU admissions and prolonged hospital stays.

Interestingly, a striking finding in this study was the exclusive occurrence of in-hospital mortality in positive PANC 3 score group. Five cases of mortality (4.27%) were observed, occurring only in this group and it showed a statistically significant association. This finding highlights the usefulness of the PANC 3 score in identifying patients at higher risk of in-hospital mortality. Also, it reinforces its importance as a practical triage tool in resource-limited settings, enhancing clinical suspicion for disease severity while also supporting informed discussions with patients and their families about the potential risks associated with their condition. Bori et al. demonstrated that patients with elevated PANC 3 scores experienced higher mortality rates. To assess the predictive capability of the PANC 3 score for mortality, receiver-operating characteristic (ROC) curve analysis was performed, yielding an area under the curve (AUC) of 0.886 (95% CI, 0.819–0.964), indicating a high accuracy of the PANC 3 score in predicting mortality in acute pancreatitis cases.[23] It aligns with the finding observed in the current study. In contrast, Beduschi et al. and Rongpi et al., in their study, found no significant correlation between a PANC 3 score with all the three parameters present and mortality in patients with acute pancreatitis. This lack of association may have been attributed to the small sample size of 64 and 46 respectively in those studies.[11,16]

In the current study, though statistical significance was found between PANC 3 score and in hospital mortality ($p = 0.029$), the possibility of a statistically low power in this association led to the evaluation of post hoc power analysis. The post hoc power was calculated to be only 46.1% indicating a potential for a Type II error.

The study done by Rongpi et al and Beduschi et al., demonstrated a statistically significant association between PANC 3 score and the requirement for ICU care. Additionally, Rongpi et al. found a statistically significant relationship between PANC 3 score and the length of ICU stay, with a p-value of 0.042, mirroring the findings of Beduschi et al which observed a p-value of < 0.001.[11,16] Notably, these findings resonate with the results of the current study, where a significant association between PANC 3 positivity and ICU admission was observed. These consistent results emphasize the PANC 3 score's potential as a predictor for critical care needs in patients with acute pancreatitis. By effectively predicting ICU requirements, this enables clinicians to timely refer patients to higher center with ICU facilities. So, this finding particularly highlights the applicability of this scoring in our local healthcare settings, where resources for managing acute pancreatitis are often limited, making PANC 3 score systems both practical and impactful.

Globally, the average LOS for AP varies based on the severity of the disease and associated complications. For moderate severe AP, the duration of hospital stay typically ranges between 6 to 12 days, while patients with severe AP have longer stays, sometimes extending to 40 days.[24] Locally, the median duration of hospital stay in a descriptive cross-sectional study conducted by Basukala et al. done in a tertiary center in Nepal involving 1,560 patients with acute pancreatitis was 4 (3–5) days.[4] In

contrast to our findings, where a positive PANC 3 score demonstrated a significant correlation with the length of hospital stay, studies by Beduschi et al. and Rongpi et al. did not observe such an association.[11,16] This divergence highlights the variability in outcomes across studies and suggests potential influences of sample size, population differences, or study design on these results.

The findings in current study underscores the impact of disease severity on recovery times. Locally, this observation is particularly relevant, given the limited availability of hospital beds in many of our hospitals. The statistically significant relationship between PANC 3 scores and hospital stay duration sheds a light on the broader economic and healthcare burden associated with SAP. Longer hospitalizations contribute to increased healthcare costs, reinforcing the need for proactive measures for effective utilization of resources.

The current study observed that patients who had a positive PANC 3 score demonstrated worse outcomes, including higher ICU admissions and longer hospital stays. This is consistent with prior findings by Brown et al., who reported that the PANC 3 score effectively predicts severe acute pancreatitis (SAP) with a sensitivity of 80% and specificity of 95.5% in their study of 393 patients. Their research highlighted the post-test likelihood ratio of 99% for developing SAP when all three parameters—BMI > 30, hematocrit > 44%, and pleural effusion—were present. This underscores the utility of the PANC 3 score as a practical tool for early risk stratification.

The strengths of this study includes its prospective design and adequate sample size. Additionally, a major strength of this study is its methodological rigor, including the use of appropriate statistical tests to analyze continuous and categorical variables. The implications of this study are also multifaceted. First, the association between PANC 3 scores and adverse outcomes emphasizes its potential as a bedside tool for early risk stratification in emergency, especially in low-resource settings, where advanced diagnostic modalities may be unavailable. Second, the findings emphasize the need for targeted interventions in patients with higher PANC 3 scores. Early ICU admission and proactive management could mitigate the risk of complications, reducing overall mortality and morbidity. Third, the association between PANC 3 scores and prolonged hospital stays highlights the need for efficient discharge planning and post-hospitalization care, particularly in resource-constrained environments. Moreover, it opens the door for future research to further validate and refine the PANC 3 score in larger and more diverse populations, potentially leading to its wider adoption and integration into clinical practice worldwide.

This study has several limitations that should be considered when interpreting its findings. First, it was conducted at a single centre and used convenience sampling rather than a randomized sampling approach, which may limit the external validity and generalizability of the results. Second, the study evaluated in-hospital mortality rather than early or 24-hour mortality; therefore, deaths occurring during the initial stages of illness may have been underrepresented. Third, although the study assessed the duration of hospital stay, it did not investigate the specific causes of prolonged hospitalization. Factors such as post-procedure complications, delayed recovery from comorbid conditions, or socioeconomic

barriers to discharge may have contributed to prolonged hospital stay. Furthermore, the association between PANC-3 scores and ICU admission may have been influenced by unmeasured confounding factors. Also, the post hoc power analysis for mortality suggests that larger studies with a greater number of outcome events are required to adequately evaluate the association between PANC-3 scores and mortality. In addition, patients with chronic kidney disease and anemia were excluded, which may limit the applicability of the findings to those with these common comorbidities. Also, patients who receive treatment outside this facility was not excluded and so treatment received outside this facility could have altered lab parameter of PANC 3 score such as Hematocrit. Finally, as this was an observational study, the findings demonstrate associations rather than causal relationships; therefore, causality between PANC-3 scores and the clinical outcomes assessed cannot be inferred.

CONCLUSION

Despite acknowledged limitations, this study found statistically significant association between PANC 3 score and key outcomes in acute pancreatitis, including in hospital mortality, ICU requirement and duration of hospital stay. Hence, this study provided compelling evidence that the PANC 3 score is a simple, effective and valuable tool for predicting the outcome of patients presenting with acute pancreatitis.

Abbreviations

AP
Acute Pancreatitis
APACHE II
Acute Physiologic and Chronic Health Evaluation II
AUC
Area under the curve
BISAP
Bedside Index of severity of Acute Pancreatitis
BMI
Basal Metabolic Rate
HDU
High Dependency Unit
ICU
Intensive Care Unit
PAHS
Patan Academy of Health Sciences
ROC
Receiver Operating Characteristic
SAP
Severe Acute Pancreatitis

Declarations

CONSENT TO PARTICIPATE

The study was approved by the Institutional Review Committee of Patan Academy of Health Sciences (IRC-PAHS) (Ref: PMG2305021719). Informed consent to participate was obtained from all participants / waived due to the observational nature of the study.

CONSENT FOR PUBLICATION

Not applicable

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

FUNDING

This study received no external funding. Hematocrit and chest X-ray were part of the routine investigations and did not incur additional costs for the patient. All other miscellaneous expenses were covered by the researcher.

Author Contribution

Dr. Kipa Shrestha conceptualized and designed the study, conducted data collection and analysis, and drafted the manuscript. Dr. Samita and Dr. Suraj contributed to manuscript editing, critical revision, and final approval of the article. All authors read and approved the final manuscript.

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Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

ETHICAL CONSIDERATION

1. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.
2. The approval of the study was obtained from the Institutional Review Committee (IRC) of Patan Academy of Health Sciences (PAHS), following which the study was started.
3. Informed written consent was obtained from all patients.
4. For the written consent, generic PAHS format in English and Nepali language were used.
5. If the patient was unable to give consent, consent was taken from the nearest kin.
6. A statement indicating that the participant had understood all the information in the consent form and was willing to participate voluntarily was obtained.
7. Participants were well explained regarding the research detail, its significance, the benefit and harm in the language they understood before obtaining the written consent.
8. If they had any queries, it was also answered.
9. Along with this participants were also informed about the choice to withdraw from the study at any time without giving any reason during the study period.
10. Following the data collection, proforma of the patients were kept in a safe locker and the data were entered and analysed in a password protected computer maintaining the confidentiality of all the research participants.
11. Along with it, data that can identify the participant such as name, address were not recorded.

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Figures

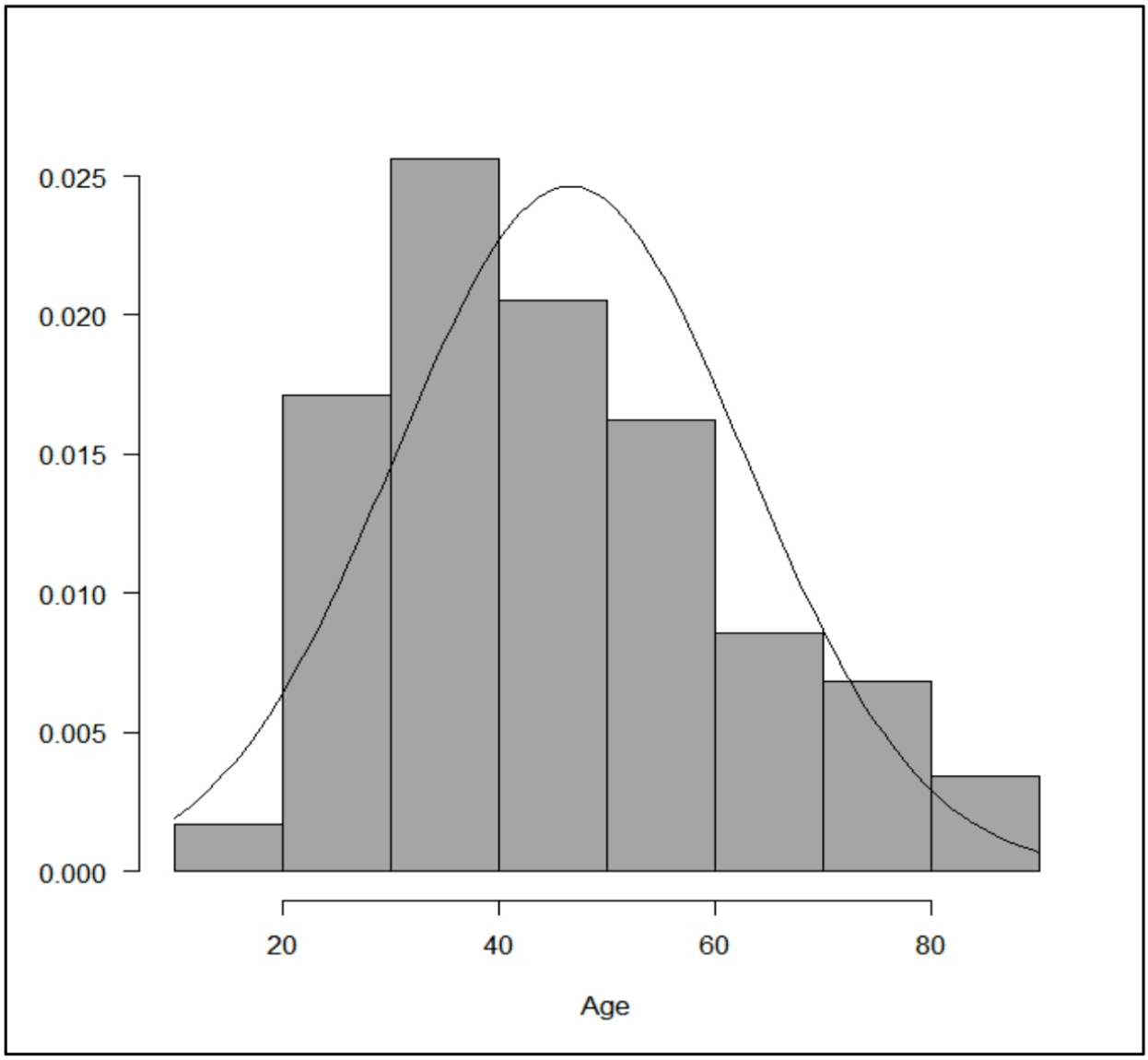


Figure 1

Normal distribution curve of age

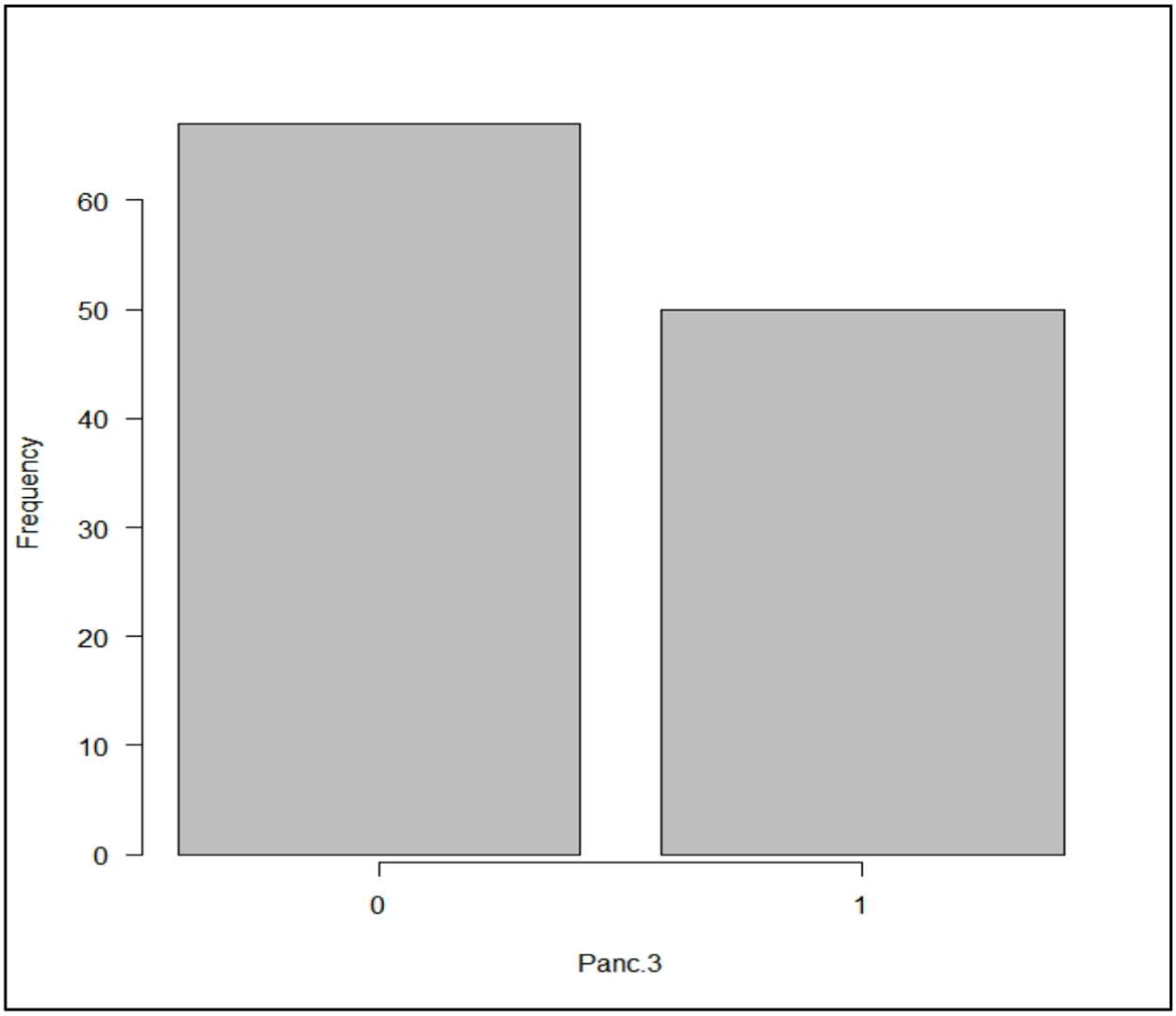


Figure 2

Bar graph showing PANC 3 score distribution in AP patients (negative score=0, positive score=1)

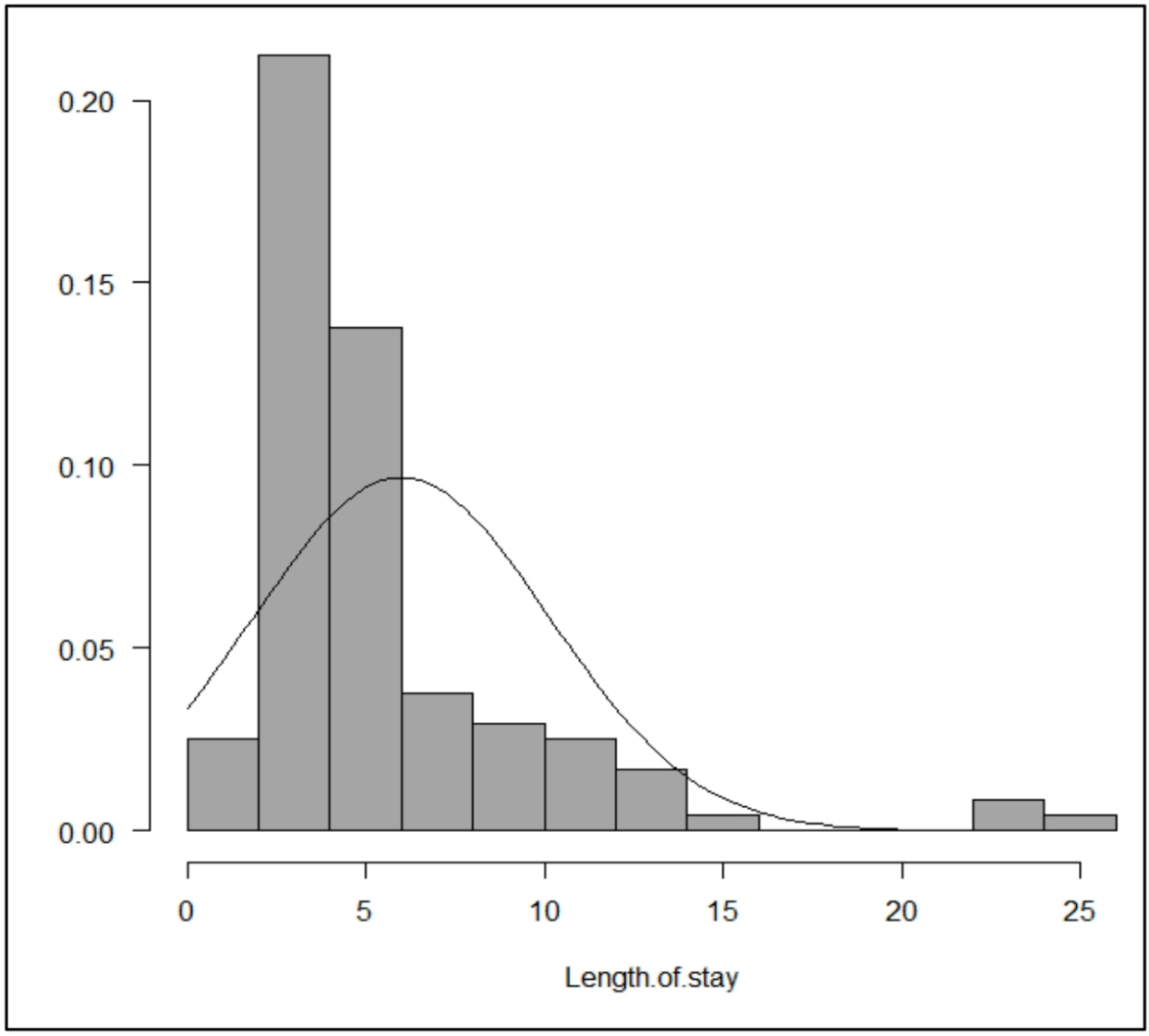


Figure 3

Normal distribution of length of hospital stay

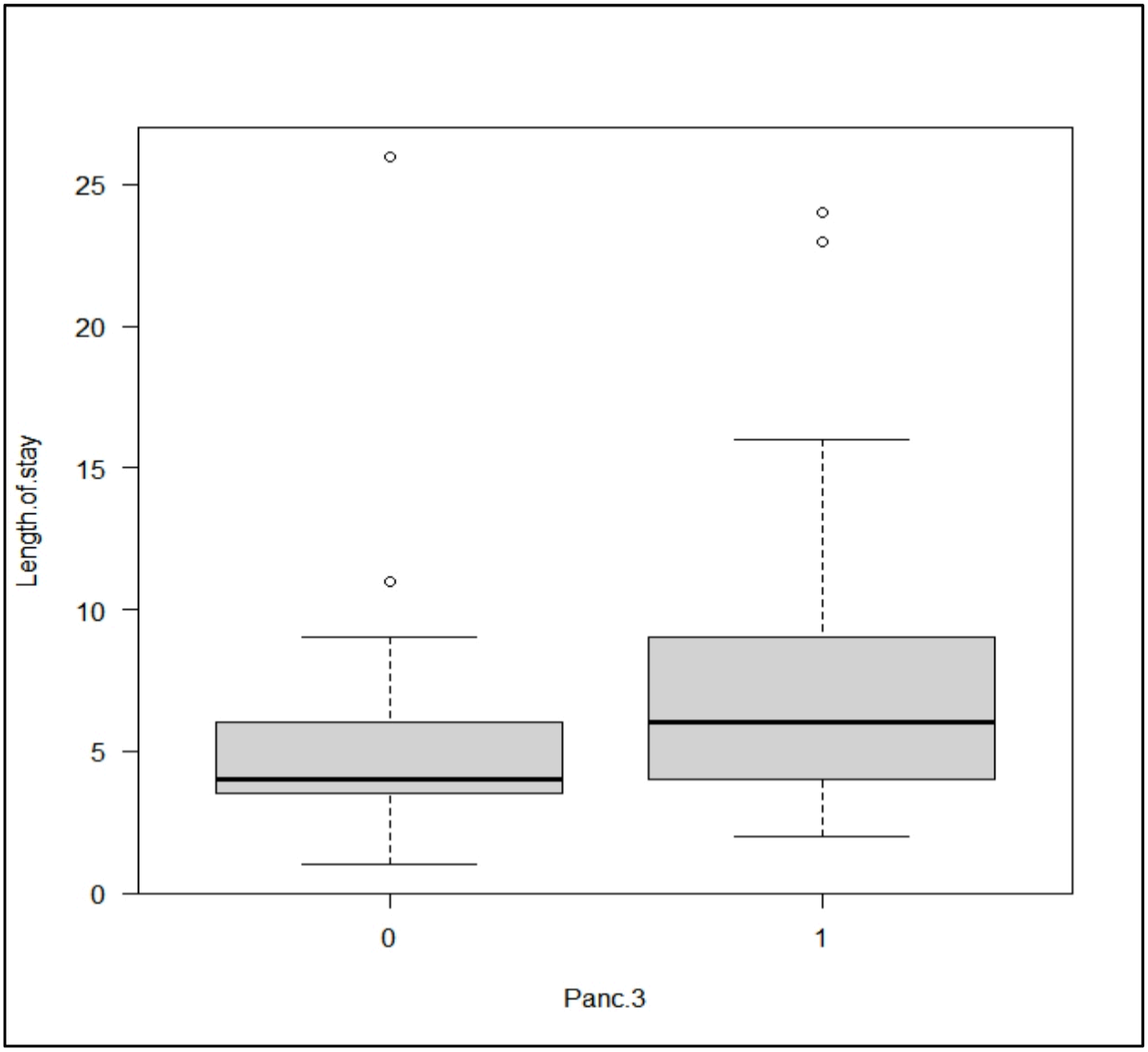


Figure 4

Boxplot showing length of hospital stay and PANC 3 score (negative score=0, positive score=1)