The Comparative Accuracy of BISAP and PANC3 Scoring System for the Disease Severity and Outcome in Acute Pancreatitis in Tertiary Care Hospital from North India

Gupta S, Dhillon HS, Gupta N

Department of General Medicine,

Maharishi Markandeshwar Institute of medical sciences and research,

Maharishi Markandeshwar Deemed to be University,

Mullana, Ambala (Haryana), India.

Corresponding Author

Sunita Gupta

Department of General Medicine,

Maharishi Markandeshwar Institute of medical sciences and research,

Maharishi Markandeshwar Deemed to be University,

Mullana, Ambala (Haryana), India.

E-mail: sunitaguptamedicine@gmail.com

ABSTRACT

Background

Acute pancreatitis has local and systemic manifestations, so it's important to assess the severity by various scoring system. Among them bed side index for severity of acute pancreatitis and pancreatitis three score have been considered to be more predictive and easier.

Objective

To determine the comparative prognostic value of bed side index for severity of acute pancreatitis and pancreatitis 3 score and its correlation with the outcome.

Method

A prospective observational study was conducted on 50 cases of acute pancreatitis. The patients were assessed clinically, radiologically and biochemically and were categorised into mild, moderate and severe category as per Atlanta Classification. Bed side index for severity of acute pancreatitis and pancreatitis 3 score was calculated at the time of admission and followed till the time of discharge or they had mortality.

Result

Receiver operating characteristic curve, showed bed side Index for severity of acute pancreatitis score had sensitivity (66.67%), specificity (84.09%), diagnostic accuracy (84%) while pancreatitis 3 score had sensitivity (50%), specificity (81.82%), diagnostic accuracy (80%) for the severity of acute pancreatitis. Bed side index for severity of acute pancreatitis had sensitivity (100%), specificity (66.67%) and Pancreatitis 3 score had sensitivity (66.67%), specificity (80.85%) for predicting the mortality in acute pancreatitis.

Conclusion

Bed side index for severity of acute pancreatitis and pancreatitis 3 score are both simple, bedside tool for assessing the severity and mortality but bed side index for severity of acute pancreatitis score had better sensitivity, specificity for assessing the severity and mortality as compared to pancreatitis three score.

KEY WORDS

Acute pancreatitis, Bed side index for severity of acute pancreatitis, Pancreatitis 3 scoring system.

INTRODUCTION

Acute pancreatitis is an inflammatory process, a common gastrointestinal emergency with significant psychosocial and financial burden with 80% of cases usually have favorable outcomes and 20% cases may develop acute necrotizing pancreatitis.[1,2] It's a Bi-phasic systemic disease. The first phase have extensive pancreatic inflammation and/or necrosis followed by a Systemic Inflammatory Response Syndrome (SIRS) that may lead to Multiple Organ Dysfunction Syndrome (MODS) and the second phase has infected pancreatic necrosis or fluid collection. Severe acute pancreatitis (SAP) develops in about 25% of patients which may require intensive care.[3,4]

Various scoring systems like SIRS, Ranson score, the Glasgow score, and acute physiology and chronic health evaluation (APACHE), CTSI score exists to predict the severity of acute pancreatitis, are based on clinical, laboratory and radiological factors.[5-7] The serum markers can be used only 24-48 hours after disease onset for the patients who are at the risk of severe acute pancreatitis.[8] These scores are not sufficiently well validated for predicting mortality.

A new prognostic scoring system, the Bedside Index Severity of Acute Pancreatitis (BISAP) and Pancreatitis 3 (PANC 3) were recently proposed as an accurate and simple method for early identification of patients, which can change the treatment protocol and the outcome.[9,10] These two scoring systems have been claimed to be useful but various literatures failed to show its comparison except one study by Taggarsi et al. from South India.[11] So, this study may be the first of its kind which compares the accuracy of the BISAP and PANC 3 scoring system in North India.

METHODS

The said study was hospital-based prospective observational study conducted at a Tertiary care Teaching and Research Institute at Haryana state of North India over the period of two years. A total 50 patients of acute pancreatitis were taken from the emergency and in patient department of the internal medicine department over a period of January 2020 - December 2021 after obtaining ethical clearance from institutional review board of Maharishi Markhandeshwar Institute of Medical Sciences Mullana, Ambala, India. All the acute pancreatitis patients were enrolled in the study after fulfilling the inclusion and exclusion criteria and after obtaining written informed consent. The inclusion criteria for diagnosing the acute pancreatitis was the presence of 2 out of 3 criteria8:

1. Abdominal pain which is acute in onset, persistent, severe epigastric pain often radiating to back.

2. Serum amylase/lipase greater than three times of upper limit of normal value.

3. Characteristic findings of ultrasonography of the abdomen or contrast-enhanced computed tomography (CECT) abdomen if needed.

The patients with carcinoma pancreas and patients with other co-morbidities that effect mortality such as Cerebrovascular Accident (CVA), Congestive Cardiac failure (CCF), Diabetes Mellitus with severe organ end-organ damage and chronic pancreatitis with a history of complications like pseudocyst were excluded from the study.

All the patients were subjected to detailed history and systemic examination. BISAP and PANC 3 scores were calculated at the time of admission and all the cases were followed till the time of discharge or mortality.

The Bedside Index Severity of Acute Pancreatitis (BISAP) score was determined by measuring the five variables obtained within 24 hours of admission after diagnosis of acute pancreatitis: 1) Bun (blood urea nitrogen) > 25 mg/dl; 2) Impaired mental status or GCS < 15; 3) SIRS; 4) Age > 60 years; 5) Pleural Effusion on chest X-ray.[9] Each variable was given a score of 1. All the patients were subjected to investigations like CBC, BUN and chest x-ray. Age, SIRS and GCS was recorded to assess the BISAP. A score of $\geq$ 3 (after sum of all the factors), indicates severe pancreatitis (early organ failure/pancreatic necrosis).

Similarly, the PANC 310 score was determined by measuring three variables obtained within 24 hours of admission after diagnosis of acute pancreatitis: 1) Hematocrit 2) Body Mass Index 3) Chest X-ray. The case was considered positive if serum hematocrit was > 44 mg/dl, BMI > 30 kg/m^2 and pleural effusion was detected on chest X-ray.

The disease severity was calculated by Atlanta Classification at the time of admission.[8] They were categorized into three categories namely : 1) mild; 2) moderate; 3) severe; based on the presence of local complications and organ failure. The local complications include: (presence of 1 or more) a) More than 1/3rd of pancreatic tissue is necrosed, b) Pseudo pancreatic cysts, c) Pancreatic abscess, d) Acute fluid collections and the organ failure includes: (if the presence of 1 or more) (if > 2+ for more than 48 hours) a) Cardio vascular system -BP < 90 mmHg (systolic), b) Respiratory system – Pa O2 < 60 mmHg, c) Gastro intestinal system – loss of > 500 ml of blood within and 24-hour period, d) Renal – creatinine > 2 mg/dl. The mild category have no local complications and organ failure, moderate category has local complications with organ failure which is transient for < 48 hours while severe category has local complications with organ failure which is transient for > 48 hours. The outcome of the patients was decided by the number of days of hospital stay, discharges, and mortality.

The data entry was done in the Microsoft EXCEL spreadsheet and the final analysis was done with the use of Statistical Package for Social Sciences (SPSS) software, IBM manufacturer, Chicago, USA, Ver 21.0.

The association of quantitative variables was analyzed using ANOVA and the association of qualitative variables was analyzed using Fisher's exact test. Inter-rater kappa was used to assess the strength of agreement between BISAP and PANC 3. Mcnamer test was used for the comparison of sensitivity and specificity. DeLong et al test was used for the comparison of the area under the curve. The receiver operating characteristic curve (ROC) of BISAP and PANC 3 was used for predicting the severity of acute pancreatitis and mortality.
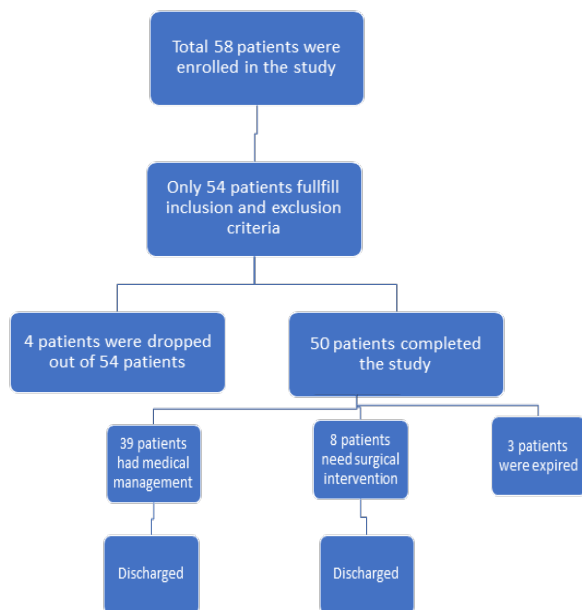

Figure 1. Flowchart of the study.

RESULTS

The total 50 patients (age group: 19-86) were included in the study who met the inclusion criteria. The mean age of the study subjects was 45.24 years with more than half of the subjects were between 28-60 years of age group with 70% males and 30% females. The most common symptoms among the subjects were pain abdomen (100%), vomiting (74%) and fever (22%). The most common etiological factor for pancreatitis was alcohol 52% followed by gall stones 30%, idiopathic 4%. All the subjects were categorized into mild 26 (52%), moderate 18 (36%) and severe 6 (12%). The mean hospital stay of mild cases were 5.5 days, moderate 9.61 days and severe 11.83 days with p value of 0.002.

The association of the BISAP score with the severity and the outcome (Table 1 and 2). BISAP score was statistically significantly associated with the severity and outcome of acute pancreatitis. The association of the PANC 3 score with the severity and outcome which was not statistically significant (Table 3 and 4). The sensitivity and specificity of BISAP and PANC 3 for predicting the severity and mortality in acute pancreatitis along with the diagnostic accuracy (Table 5).

Table 1. Association of BISAP with severity of acute pancreatitis

BISAP	Mild (n=26)	Moderate (n=18)	Severe (n=6)	P value
< 3	25 (96.15)	12 (66.67)	2 (33.33)	0.0007*
≥ 3	1 (3.85)	6 (33.33)	4 (66.67)	
Mean ± SD	1.42±1.33	3.44 ± 0.86	3.33 ± 1.03	< .0001†
Median (25th-75th percentile)	1.5(0-2.75)	3(3-4)	4(2.5-4)	

*Fisher's exact test, †ANOVA

Table 2. Association of BISAP with outcome

BISAP	Discharge (n=39)	Expired (n=3)	Patients who need surgical inter-vention (n=8)	Total	P value
< 3	33(84.62)	0(0)	6 (15.38)	39(100)	0.0003*
≥ 3	6(54.54)	3(27.27)	2 (18.18)	11(100)	
Mean±SD	6.42±2.11	4±0	3.38±1.06	2.38±1.51	0.001†
Median (25th-75th percentile)	2.5(0-3)	4(4-4)	3(3-3.5)	3(1.25-3)	
Range	0-4	4-4	2-5	0-5	

*Fisher's exact test, †ANOVA

Table 3. Association of PANC3 with severity of acute pancreatitis

PANC3	Mild (n=26)	Moderate (n=18)	Severe (n=6)	P value
< 3	18(69.23)	18 (100)	3 (50)	0.004*
= 3	8 (30.77)	0 (0)	3 (50)	
Mean ± SD	1.31±1.32	1.72±0.46	2.17±0.98	0.152†
Median (25th - 75th percentile)	1(0-3)	2(1.25-2)	2.5(1.25-3)	

*Fisher's exact test, †ANOVA

Table 4. Association of PANC3 with outcome

PANC3	Discharge (n=39)	Expired (n=3)	Patient who needs surgical interven-tion (n=8)	Total	P value
< 3	30(76.92)	1(2.56)	8(20.51)	39(100)	0.057*
= 3	9(81.82)	2 (18.18)	0(0)	11(100)	
Mean±SD	3.85±1.85	2.67±0.58	1.88±0.35	1.56±1.07	0.073†
Median (25th-75th percentile)	1(0-2)	3(2.5-3)	2(2-2)	2(1-2)	

*Fisher's exact test, †ANOVA

DISCUSSION

At present, multiple scoring systems are available for evaluating the severity of acute pancreatitis (AP). The Atlanta classification is a clinically based classification system that is most widely used and relatively universally

Table 5. Sensitivity, specificity, positive predictive value and negative predictive value of BISAP and PANC3 for predicting severity and mortality of acute pancreatitis

	SEVERITY		MORTALITY	
	BISAP	PANC 3	BISAP	PANC 3
Sensitivity (95% CI)	66.67% (22.28% to 95.67%)	50.00 % (11.81% to 88.19%)	100.00% (29.24% to 100.00%)	66.67% (9.43% to 99.16%)
Specificity (95% CI)	84.09% (69.93% to 93.36%)	81.82% (67.29% to 91.81%)	82.98% (69.19% to 92.35%)	80.85% (66.74% to 90.85%)
AUC (95% CI)	0.75(0.61 to 0.86)	0.66(0.51 to 0.79)	0.91(0.80 to 0.98)	0.74(0.59 to 0.85)
Positive predictive Value (95% CI)	36.36% (10.93% to 69.21%)	27.27% (6.02% to 60.97%)	27.27% (6.02% to 60.97%)	18.18% (2.28% to 51.78%)
Negative predictive Value (95% CI)	94.87% (82.68% to 99.37%)	92.31% (79.13% to 98.38%)	100.00% (90.97% to 100.00%)	97.44% (86.52% to 99.94%)
Diagnostic accuracy	82.00%	78.00%	84.00%	80.00%
P value	0.0619	0.133	<0.0001	0.001
Cut off	> 3	=3	>3	=3
P value of AUC	0.549§		0.518§	

‡McNemar test, §DeLong et al. test

accepted.[8] It defines the severity and complications of acute pancreatitis by evaluating both local and systemic changes. There are number of scoring systems which are used to assess the severity of acute pancreatitis. RANSON and APACHE II score are two commonly used indices to predict severity of acute pancreatitis.[5,6] Various studies showed that the sensitivity for RANSON and APACHE II was higher than the specificity. But nowadays BISAP and PANC 3 scoring systems have replaced the RANSON and APACHE II as both the RANSON and APACHE II are more complex and had low sensitivity at the time of admission.[9,10] BISAP is a newly developed scoring system for predicting Acute Pancreatitis severity and prognosis. BISAP comprises 5 variables, all of which are easy to obtain within 24 hours of admission. BISAP has the advantages of simplicity and speed over traditional scoring system. PANC 3 score was devised by Brown et al. which include three factors namely Haematocrit, Pleural Effusion and Obesity, all of which are done within 24 hours of admission.[10] Similarly, PANC 3 scoring system is very simple, rapid, and accurate and can be performed in the emergency department. It is also claimed to be good in predicting the severity of acute pancreatitis. Some studies showed that BISAP is better than PANC 3 and some showed the reverse of it. But till now there are very few studies who had done the comparative prognostic accuracy of BISAP and PANC 3.

So, the present study was aimed at comparing the prognostic accuracy of BISAP and PANC 3 for the assessment of severity and the outcome of acute pancreatitis.

In the present study, fifty patients were evaluated over a period of two years. The severity of the patient was classified according to Atlanta classification into three categories i.e. mild, moderate and severe. In our study, out of 50 patients, 52% cases were having mild acute pancreatitis, 36% cases were moderate and 12% cases were severe. The mean age for presentation was 45 years and more than 50% were between 28-60 years of age. Shakeel et al. also observed that, the mean age of study subjects was 37.4 years.[12] This shows that acute pancreatitis is common in young and middle age group.

As alcoholism is very prevalent in our society and it is common in every section of our society so, alcohol was the most common etiological factor for pancreatitis in men found in our study.[13] The majority of the patients were alcoholic 52%, 30% had Gall stone induced,10% as Post Cholecystectomy, 4% as Idiopathic, 2% as Post ERCP, 2% as Trauma. Others studies like Prasad et al., Negi et al. and Panda et al. also observed that the most common etiology of acute pancreatitis was alcoholism (50%) while in female cases was biliary (72%).[14-16]

As table 1 shows the BISAP score with the cut off value 3 associated with the severity of acute pancreatitis. Table 2 shows that, 39 subjects had a BISAP score < 3, out of which 33 subjects were discharged, none was expired and 6 needed surgical intervention with p value of 0.0003. Out of 11 subjects who had a score of ≥ 3, 6 subjects were discharged, 3 were expired and 2 needed surgical intervention with p value of 0.0003 which was statistically significantly associated with the outcome of acute pancreatitis. In our study, all the 5 parameters of BISAP score were statistically significantly associated with the severity and outcome of acute pancreatitis.

In PANC 3 score, the mean haematocrit value of patients having mild, moderate and severe category was 37.49%, 43.7% and 42.9% respectively with the p value of 0.038 which is statistically significantly correlated with the severity of acute pancreatitis. Brown et al. also observed that the hemo concentration can be used as a predictor of severity.[19] The mean BMI of mild, moderate and severe category were 28.64 kg/m^2, 25.61 kg/m^2 and 27.83 kg/m^2 respectively with the p value of 0.202. The overall mean BMI is also < 25 kg/m^2. Thus, in our study the BMI was not able to predict the severity and outcome of acute pancreatitis. But the other studies showed that the severity of acute pancreatitis is influenced by BMI of patient.[20]

Pleural effusion on chest X-ray was seen in 15.38% subjects of mild category, 88.89% of moderate category and 83.33% of severe acute pancreatitis with p value of < 0.0001 which is statistically significantly correlated with the severity of acute pancreatitis in our study. These findings were similar to that observed by Heller et al. who in their study found abnormal chest radiograph in 84.2% of their patients.[21]

As table 3 shows the PANC 3 score with the cut off value 3 associated with the severity of acute pancreatitis. Table number 4 shows that, out of 39 subjects who had a PANC 3

score < 3, 30 subjects were discharged, one got expired and 8 needed surgical intervention. In our study, 39 subjects who had PANC3 score < 3, one got expired but in BISAP none was expired who had BISAP score < 3. Out of 11 subjects who had a score of = 3, 9 subjects were discharged, 2 were expired and none needed surgical intervention with p value of 0.057 which was not statistically significantly associated with the outcome of acute pancreatitis. In our study, out of the three parameters of PANC 3 score, BMI was not correlated with the severity and outcome of acute pancreatitis. The overall mean BMI of our study subjects were < 25 kg/m^2. In all over the world the main etiological cause of acute pancreatitis is alcohol. Usually, the alcoholic patients are malnourished and had a lower BMI as comparative to the normal population. So, may be due to this reason, BMI was not correlated with the severity of acute pancreatitis.

As table 5 shows that, the BISAP score is more sensitive, specific and more diagnostic accurate as PANC 3 score. So, it was seen that BISAP was more accurate in predicting the severity and outcome of acute pancreatitis. Taggarsi et al. also observed that the sensitivity of BISAP score for the prediction of severity was more as comparison to PANC 3 score.[11]

On the contrary, findings from various other studies like Panda et al. and Shah et al. observed that the PANC 3 score was more accurate in predicting the severity of acute pancreatitis.[22,23]

Table 5 shows that BISAP score was more accurate in predicting mortality for the score (cut off value > 3) as compared with PANC 3 for the score (cut off value 3). In our study PANC 3 score is not correlating with the outcome as compared to the BISAP score. In our study,

other parameters which were associated with the severity of acute pancreatitis were pulse rate, respiratory rate, temperature, age, GCS, TLC, BUN, Hemoconcentration, Pleural effusion on chest X-ray. All of these are associated with the severity of acute pancreatitis.

This was a single centered prospective study. The follow up period was limited to the duration of hospitalization was less to know the exact outcome of the patients after the discharge. A larger multi centered study with prolonged follow up which can provide the strong association for the outcome.

CONCLUSION

BISAP score is effective in detecting the severity and predicting the mortality of patients with severe acute pancreatitis. PANC3 is comparable to BISAP in detecting the severity but not statistically significantly correlated with the outcome. BISAP score had the diagnostic accuracy of 82% as compared to PANC3 score 78%. BISAP score is more accurate for detecting the severity and outcome as compared to the PANC3 score in acute pancreatitis. PANC3 score is easy to calculate and has only 3 parameters, so it can be used in cases of acute pancreatitis especially in resource limited settings. In the future, more meta-analysis studies are needed to decide the comparative accuracy of the two scores.

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REFERENCES

1. Tenner S, Baillie J, DeWitt J, Vege SS. American College of Gastroenterology. American College of Gastroenterology guideline: management of acute pancreatitis. *Am J Gastroenterol*. 2013 Sep;108 (9):1400-15; 1416.

2. Isenmann R, Beger HG. Natural history of acute pancreatitis and the role of infection. *Baillieres Best Pract Res Clin Gastroenterol*. 1999 Jul;13 (2):291-301.

3. McKay CJ, Imrie CW. Staging of acute pancreatitis. Is it important? *Surg Clin North Am.* 1999 Aug;79 (4):733-43.

4. Uhl W, Warshaw A, Imrie C, Bassi C, McKay CJ, Lankisch PG, et al. International Association of Pancreatology. IAP Guidelines for the Surgical Management of Acute Pancreatitis. *Pancreatology*. 2002;2 (6):565-73.

5. Ranson JH, Rifkind KM, Roses DF, Fink SD, Eng K, Spencer FC. Prognostic signs and the role of operative management in acute pancreatitis. *Surg Gynecol Obstet*. 1974 Jul;139 (1):69-81.

6. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. *Crit Care Med*. 1985 Oct;13 (10):818-29.

7. Balthazar EJ, Robinson DL, Megibow AJ, Ranson JH. Acute pancreatitis: value of CT in establishing prognosis. *Radiology*. 1990 Feb;174 (2):331-6.

8. Bollen TL, van Santvoort HC, Besselink MG, van Leeuwen MS, Horvath KD, Freeny PC, et al. Dutch Acute Pancreatitis Study Group. The Atlanta Classification of acute pancreatitis revisited. *Br J Surg*. 2008 Jan;95 (1):6-21.

9. Villacís X, Calle P, Patiño J, Calle G. Validación del score de BISAP como sistema pronóstico en pancreatitis aguda [Score BISAP validation as a prognostic system in acute pancreatitis]. *Rev Gastroenterol Peru*. 2011 Jul-Sep;31(3):230-5.

10. Brown A, James-Stevenson T, Dyson T, Grunkenmeier D. The panc 3 score: a rapid and accurate test for predicting severity on presentation in acute pancreatitis. *J Clin Gastroenterol.* 2007 Oct;41 (9):855-8.

11. Taggarsi M, Kumar A, Ravishankar HR. A comparative study of severity scoring systems in acute pancreatitis. *Int J Surg Sci*. 2020;4(2):237-41.

12. Shakeel MD, Irfan SS. Clinical profile of patients with pancreatitis. *Int Surg J*. 2017; 4:534-7.

13. Samokhvalov AV, Rehm J, Roerecke M. Alcohol Consumption as a Risk Factor for Acute and Chronic Pancreatitis: A Systematic Review and a Series of Meta-analyses. *E Bio Medicine*. 2015 Nov 14;2(12):1996-2002.

14. Prasad HL, Nagarjuna TR. Clinical profile of patients with acute pancreatitis. *Int J Res Med Sci*. 2016; 4:2994-7.

15. Negi N, Mokta J, Sharma B, Sharma R, Jhobta A, Bodh V, et al. Clinical Profile and Outcome of Acute Pancreatitis: A Hospital-Based Prospective Observational Study in Subhimalayan State. *J Assoc Physicians India.* 2018 Mar;66(3):22-4.

16. Panda CR, Misra B, Behera SK, Das HS, Singh SP. A Study on Changing Clinical Profile of Chronic Pancreatitis from a Tertiary Care Centre. *Int J Sci Stud.* 2017;5 (4):170-3.

17. Lalithkumar J, Chitra T, Kodieswaran N. Comparative study between BISAP and Ranson's score in predicting severity of acute pancreatitis. *Int Arc Intg Med*. 2016 Sep;3:23-33.

18. Park JY, Jeon TJ, Ha TH, Hwang JT, Sinn DH, Oh TH, et al. Bedside index for severity in acute pancreatitis: comparison with other scoring systems in predicting severity and organ failure. *Hepatobiliary Pancreat Dis Int.* 2013 Dec;12 (6):645-50.

19. Brown A, Orav J, Banks PA. Hemoconcentration is an early marker for organ failure and necrotizing pancreatitis. *Pancreas*. 2000 May;20 (4):367-72.

20. Martínez J, Sánchez-Payá J, Palazón JM, Suazo-Barahona J, Robles-Díaz G, Pérez-Mateo M. Is obesity a risk factor in acute pancreatitis? A meta-analysis. *Pancreatology.* 2004;4 (1):42-8.

21. Heller SJ, Noordhoek E, Tenner SM, Ramagopal V, Abramowitz M, Hughes M, Banks PA. Pleural effusion as a predictor of severity in acute pancreatitis. *Pancreas.* 1997 Oct;15(3):222-5.

22. Panda CR, Misra B, Behera SK, Das HS, Singh SP. A Study on Changing Clinical Profile of Chronic Pancreatitis from a Tertiary Care Centre. *Int J Sci Stud.* 2017;5(4):170-3.

23. Shah AS, Gupta AK, Ded KS. Assessment of PANC3 Score in Predicting Severity of Acute Pancreatitis. *Niger J Surg*. 2017 Jan-Jun;23 (1):53-7.