Comparison of bedside index for severity in acute pancreatitis(BISAP) and modified CT severity index(MCTSI) for predicting the severity of hyperlipidemic acute pancreatitis(HLAP)

Lan Nie
Wuhan Univesity of Science and Technoligy School of Medicine https://orcid.org/0000-0002-8009-1867
Yi Cheng
Chinese PLA General Hospital of Central Theater Command
Fei Yao
Wuhan University of Science and Technology school of Medicine
Ru Shuo Wu
Wuhan University of Science and Technology of Medicine
Ming Li
Chinese PLA General Hospital of Central Theater Command
Junjun Zhang
Chinese PLA General Hospital of Central Theater Command
Ming qing Wu (wuhe9224@sina.com)
Hui Long
Tianyou Hospital Affiliated to Wuhan University of Science and Technology
Ming Xiang Fang
Puren Hospital Affiliated to Wuhan University of Science and Technology

Research article

Keywords: Hyperlipidemic acute pancreatitis; Triglycerides; BISAP score; MCTSI score; Severe acute pancreatitis

Posted Date: February 7th, 2020

DOI: https://doi.org/10.21203/rs.2.17351/v2

Abstract

Background: In recent years, the incidence of hyperlipidemic acute pancreatitis(HLAP) is rapidly increasing. It is important for clinicians to identify the severity at early stage of HLAP. AIMS: The goal of this paper was to compare bedside index for severity in acute pancreatitis(BISAP) and modified CT severity index(MCTSI) for predicting the severity and local complications of HLAP. Methods: We collected 167 patients with HLAP, including 133 cases of Mild acute pancreatitis(MAP), 34 cases of Moderately severe acute pancreatitis(MSAP) and Severe acute pancreatitis(SAP). The study retrospectively analyzed the clinical characteristics of two groups(MAP group,MSAP and SAP group) of patients. Correlation analysis was demonstrated by Spearman,s test. In addition,the accuracy was investigated through the study of the receiver operating characteristic(ROC) curve to predict the severity of HLAP by BISAP and MCTSI score. Results There are significantly statistical differences(P<0.05) in Triglycerides(TG), Total cholesterols(TC), Hospitalization days, Fatty liver and Local complications between two groups. However, there are no statistical differences(P>0.05) in Gender, Age,Serum amylase, Alanine aminotransferase(ALT), Aspertate aminotransferase(AST), Hypertension, Type2 diabetes and Hyperuricemia. The Area Under the Curve(AUC) of BISAP and MCTSI in predicting the severity of HLAP respectively were 0.89 0.78, sensitivity were 73.5% 79.4%, specificity were95.5% 60.2%, positive predictive value(PPV) were 80.6% 33.8%, negative predictive value(NPV) were 93.4% 92.0%. Furthermore, the AUC respectively were 0.73 0.87, sensitivity were 37.5% 90.1%, specificity were 93.2% 78.6%, PPV were 77.4% 72.5%, NPV were 70.6% 93.1% in predictionig local complications. Conclusion Compared to MCTSI score, BISAP score may be a better prognostic scoring system for predicting the severity of HLAP in view of accuracy and easiness. Keywords: Hyperlipidemic acute pancreatitis; Triglycerides; BISAP score; MCTSI score; Severe acute pancreatitis

Background

Acute Pancreatitis(AP) is an acute inflammatory disease triggered by a variety of causes. According to 2012 revised Atlanta classification criteria, AP was grouped into Mild acute pancreatitis(MAP) Moderately severe acute pancreatitis(MSAP) and Severe acute pancreatitis(SAP), with a total mortality rate of 5% ~ 10%, but the mortality rate of SAP was relatively higher, which is about 36% ~ 50%[1]. In China, it is well established that biliary diseases are the primary causes of AP[2]. However, with the improvement of economic and changes in lifestyle, the incidence of hyperlipidemic acute pancreatitis(HLAP) is rapidly increasing year by year, accounting for around 10.36%. Morever, there are much higher recurrences and hospitalization costs[2].

Currently, the majority of scoring systems are applied to access the severity of AP, including Ranson,s score, the Acute Physiology and Chronic Health Evaluation (APACHE II) score, BISAP score, MCTSI score, et al[3-6], but there is no unified standard clinically. Modified CT severity index(MCTSI) is a scoring system formed on the basis of CT severity index(CTSI), which could not only reflect pancreatic inflammation and necrosis, but also indicate organ failure and extrapancreatic complications[3]. Bedside index for severity

in acute pancreatitis(BISAP) score was formally proposed by Wu[4] in 2008, the latest among other scores. When BISAP ≥ 3, expected to be MSAP and SAP, the mortality rate markedly increased. Due to BISAP and MCTSI scores are able to repeatedly evaluate diseases condition and easy to obtain, there are utilized by more and more clinicians.

The aims of our study were to primarily investigate the value of BISAP for predicting the severity of HLAP and compared with MCTSI.

Methods

Data collection

We collected 167 patients with HLAP in The General Hospital of People's Liberation Army, Tianyou Hospital Affiliated to Wuhan University of Science and Technology and Puren Hospital Affiliated to Wuhan University of Science and Technology from January 2017 to December 2018. The exclusion criterias included patients with malignant tumour, pregnancy and transferred from other hospital. Two patients were absent from further analysis for imaging information missing.

The diagnosis of AP demands at least two of the following three characteristics: ①abdominal pain consistent with acute pancreatitis(acute onset of a persistent, severe, epigastric pain often radiating to the back); ②serum lipase activity (or amylase activity) at least three times greater than the upper limit of normal; and ③characteristic findings of acute pancreatitis on computed tomography (CT) and less commonly magnetic resonance imaging (MRI) or transabdominal ultrasonography. In addition to above features, HLAP was diagnosed if TG met 11.0mmol/L, or ranged from 5.56 to 11.0mmol/L but accompanied with chylemia, except for other etiologies of AP, namely, gallstone、drug、infection、et al. The category of severity(MAP、MSAP、SAP) and local compications(acute peripancreatic fluid collection, pancreatic pseudocyst, acute necrotic collection and walled-off necrosis) were in accordance with 2012 revised Atlanta criteria.

BISAP score contained[4]: ①blood urea nitrogen (BUN) >25 mg/dl; ②impaired mental status; ③systemic inflammatory response syndrome(SIRS); ④age >60 years; ⑤or the presence of a pleural effusion, which were calculated within the first 24h after admission(each one represents 1 point).

The indicator of MCTSI[3]: ①Pancretic inflammation:Normal pancreas 0 point, Intrinsic pancreatic abnormalities with or without inflammatory changes in peripancreatic fat 2 points,Pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis 4 points; ②Pancreatic necrosis: None 0 point, ≤30% 2 points, > 30% 4 points; ③Extrapancreatic complications (one or more of pleural effusion, ascites, vascular complications, parenchymal complications, or gastrointestinal tract involvement) 2 points, were collected within one week of onset of symptoms and evaluated by two radiologists and one clinicians.

Statistical Analysis

SPSS 24.0 software was used for statistical analysis. Descriptive data were performed as mean and standard deviation, Categorical data as frequencies and percentages. Groups comparison used Student,s t-test for Descriptive data and Chi-square or Fishers, exact test for Categorical data. Correlation analysis was demonstrated by Spearman,s test. Finally, ROC curve was drawn corresponding AUC and sensitivity, specificity, PPV, NPV, Youden index computed. $P < 0.05$ was considered statistically significant.

Results

As showing in table 1, table 2, table 3. The study enrolled 167 patients with HLAP. There were 133 MAP petients, with 90 male(67.7%) and an average age of (39.8±11.0) years, 34 MSAP and SAP petients, with 24 male(70.6%) and an average age of (39.7±11.0) years, indicating no significant difference ($P > 0.05$). TG, TC, hospital days and BISAP scores for MSAP and SAP patients were great higher than MAP petients ($P < 0.05$). However, ALT, AST, blood amylase had no obvious difference among groups ($P > 0.05$). Moreover, The presence of fatty liver, local complications was higher in MSAP and SAP compared to in MAP ($P < 0.05$). The occurrence of type 2 diabetes, hypertension, hyperuricemia demonstrated no difference between the two groups ($P > 0.05$). There were statistically significant for BISAP and MCTSI scores in predicting severity and local complications($P<0.05$).

As seen in table 4, Fig 1, Fig 2. When BISAP score ≥ 3, in forecasting MSAP and SAP, the AUC was 0.89, sensitivity, specificity, PPV, NPV were 73.5%、95.5%、80.6%、93.4% respectively, Youden index was 0.69. In forecasting local complications,the AUC was 0.73, sensitivity, specificity, PPV, NPV were 37.5%、93.2%、77.4%、70.6% respectively , Youden index was 0.31. When MCTSI score ≥ 4, the AUC、Youden index、sensitivity、specificity、PPV、NPV were 0.78、0.40、79.4%、60.2%、33.8%、92.0% for severity and 0.87、0.69、90.1%、78.6%、72.5%、93.1% for local complications.

As seen in Fig 3. There are significant association between BISAP and TG with r of 0.55.

Discussion

In 1952, Klatskin[7] first proposed that hyperlipidemia was able to cause AP. It was widely recognized that gallstones and alcoholism were the two major contributing factors for AP, while hyperlipidemia was less frequency, only making up 4-10%[8]. Recently, people's lifestyle and dietary habits gradually westnized, which bringing about the elevated incidence for HLAP. Zheng et al[2] investigated the changing trend of AP etiology during the period of five years in Beijing, founding that the occurrence of HLAP had been increasing year after year. In this report, HLAP surpassed alcoholic pancreatitis as the second largest etiological diagnosis. Compared to other types AP, HLAP had more complex pathological mechanism, faster aggravation, easier relapse, and the mortality rate of which was as high as 30%[9]. Therefore, it is crucial to predict the severity at early stage for better individualized treatment and management.

Our study highlighted that there were more man(67.7% in MAP, 70.6% in MSAP and SAP) than woman(32.3% in MAP, 29.4% in MSAP and SAP) patients with young ages(39.8±11.0 in MAP, 39.7±11.0

in MSAP and SAP) of HLAP, which was in line with the report of Li et al[10]. This phenomenon probably was responsible for strong work and life pressure, alcohol abuse, smoking, absent exercise, high-calorie food(such as high-fat diet, high-sugar diet), and irregular sleeping schedule in this group. Additiongly, TG in MSAP and SAP group (23.3±12.0) mmol/L was group. In accordance, a report showed that 100% patients had fatty liver in MSAP and SAP and 59% in MAP. Besides, the severe degree of fsignificantly higher than MAP group (13.1±8.2) mmol/L. Consistently, an analysis carried by Wang et al[11]indicated that when TG > 20.0mmol/L, MSAP and SAP patients accounted for 63.1%, which was also greatly higher than MAP petients. Oh et al[12] and Yadav et al[13] believed that the occurrence and mortality rate of AP will be reduced when TG is controlled under 5.65mmom/L. In our study, the proportion of fatty liver in MSAP and SAP group was 82.4% and 50.4% in MAP atty liver elevated accompanied with TG increased [14]. Hence we guess that the influence of fatty liver for HLAP depends on the change of TG level.

BISAP was derived on data collected from 17 992 cases of AP from 212 hospitals in 2000–2001 and validated by 18256 AP cases from 177 hospitals in 2004-2005. In this study, Wu et al concluded BISAP was as effective as APACHE II to evaluate in-hospital mortality[4]. A report demonstrated the accuracy of BISAP for severity of AP were not worse than “traditional” scoring systems(Ranson score,APACHE II,MCTSI et al)[15]. Qiu et al[16]observed the AUC, sensitivity, specificity respectively were 0.905, 1.000, 0.604 for BISAP score in the prediction of SAP, which higher than MCTSI score with the AUC, sensitivity, specificity being 0.834, 0.800, 0.868. In our study, BISAP score also performed better in predicting MSAP and SAP than MCTSI score. Moreover, we also found that BISAP had a close correlation with TG, which both were in connection with severity of HLAP. It could further assume that BISAP had a high accuracy to estimate the severity risk of HLAP.

MCTSI is a major clinical imaging scoring system showed strongly correlation with morbidity and local complications of AP[17-18]. A study revealed that MCTSI manifested certain accuracy for the death of HLAP patients compared with nonhyperlipidemic acute pancreatitis(NHLAP)[15]. According to the retrospective research from Yang et al[19], MCTSI score had outstanding performance in the prediction of local complications but poor in severity compared to BISAP. That conforms to our study. However, there are still some limitations in clinical practise for MCTSI score. Firstly, We need to supervise the state repeatedly because of instantly changing of disease, which evidently lifting the economic burden of patients with contrast-enhanced CT. In addition, contrast agents are harmful to the kidney, so contrast-enhanced CT for patients with renal injury will be limited.

Conclusions

We possibly concluded that TG had a tightly relevant to severity of HLAP. BISAP score had the advantages of few parameters and easy to implement with higher AUC in the prediction of severity than MCTSI score. We are responsible to compare BISAP score with other else scoring system or integrate other scoring system and laboratory indexes to comprehensively verify severity.

Abbreviations

BISAP:bedside index for severity in acute pancreatitis; MCTSI:modified CT severity index;MSAP:Moderately severe acute pancreatitis ;HLAP: Hyperlipidemic acute pancreatitis;MAP:Mild acute pancreatitis;TC:Total cholesterols;SAP: Severe acute pancreatitis;ROC: receiver operating characteristic;TG:Triglycerides; AST: Aspertate aminotransferase;AUC:Area Under the Curve;ALT:Alanine aminotransferase; PPV:positive predictive value;NPV:negative predictive value; APACHE II:the Acute Physiology and Chronic Health Evaluation; CTSI:CT severity index; CT:computed tomography; MRI:magnetic resonance imaging;BUN: blood urea nitrogen;SIRS: systemic inflammatory response syndrome; NHLAP: nonhyperlipidemic acute pancreatitis.

Declarations

Acknowledgements

Not applicable

Author,s contribution

L N conceived the study; L N and QM W participated in the design and drafted the manuscript;L N, SR W, F Y, XM F, H L and Y C collected the data and performed statistical analyses.QM W, Y C, M L and JJ Z edited and checked the manuscript.All of the authors have read and approved the final manuscript.

Funding

Not applicable.

Availability of data and materials

All data generated or analysed during this study are included in this published article [and its supplementary information files]

Ethics approval and consent to participate

The study was approved by the ethics committees of the General Hospital of People's Liberation Army,Tianyou Hospital Affiliated to Wuhan University of Science and Technology and Puren Hospital Affiliated toWuhan University of Science and Technology.Written informed consent of each patient was waived as it was a retrospective study.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests

References

1. Banks PA, Bollen TL, Dervenis C, et al. Classification of acute pancreatitis-2012: revision of the Atlanta classification and definitions by international consensus[J].Gut. 2013;62:102-111 DOI:10.1136/gutjnl-2012-302779
2. Zheng Y,Zhou Z,Li H,et al.A multicenter study on etiology of acute pancreatitis in Beijing during 5 years[J].Pancreas.2015;44:409-414.DOI:10.1097/MPA.0000000000000273
3. Mortele KJ,Wiesner W,Intriere L,et al.A modified CT severity index for evaluating acute pancreatitis: improved correlation with patient outcome[J]. AJR Am J Roentgenol. 2004; 183:261-1265.DOI: 10.2214 /ajr. 183.5.1831261
4. Wu BU, Johannes RS, Sun X,et al. The early prediction of mortality in acute pancreatitis: a large population-based study[J]. Gut. 2008; 57: 1698-170 3.DOI:10.1136/gut.2008.152702
5. Ranson JH,Rifkind KM.Prognostic signs and nonoperative peritoneal lavage in acute pancreatitis[J]. Surg Gynecol Obstet . 1976; 143: 20 9-219
6. Knaus WA,Zimmerman JE,et al.APACHE-acute physiology and chronic health evaluation: a physiologically based classification system[J]. Crit Care Med.1981;9:591-597.
7. Klatskin G. Relationship between relapsing pancreatitis and essential hyperlipemia[J].Am J Med.1952;12:3-23.
8. Adiamah A, Psaltis E, Crook M. A systematic review of the epidemiology, pathophysiology and current management of hyperlipidaemic pancreatitis[J]. Clin Nutr. 2018; 37: 1810-1822. DOI:10.1016/j.clnu. 2017.09.028
9. Valdivielso P,Ramírez-Bueno A,Ewald N.Current knowledge of hypertriglyceridemic Pancreatitis [J]. Eur J Intern Med. 2014 ;25:689-694. DOI:10.1016/j.ejim.2014.08.008
10. Li X,Ke L,Dong J,et al.Significantly different clinical features between hypertriglyceridemia and biliary acute pancreatitis: a retrospective study of 730 patients from a tertiary center[J]. BMC Gastroenterol. 2018;18:1-89.DOI:10.1186 /s12876-018-0821-z
11. Wang SH,Chou YC,Shangkuan WC,et al. Relationship between Plasma Triglyceride Level and Severity of Hypertriglyceridemic Pancreatitis[J]. PLoS One. 2016; 11: e0163984. DOI:10.1371/journal.pone.0163984
12. Oh RC, Lanier JB. Management of hypertriglyce ridemia[J].Am Fam Physician.2007;75:1365-13 71
13. Yadav D.Issues in hyperlipidemic pancreatitis[J].J Clin Gastroenterol .2003;36:54-62.
14. Xiao B,Zhang XM,Jiang ZQ,et al. Fatty liver in acute pancreatitis: characteristics in magnetic resonance imaging[J]. J Comput Assist Tomogr . 2012;36:400-405.DOI:10.1097/RCT.0b013e31825977c2
15. I. Papachristou,V. Muddana,D. Yadav et al. Comparison of BISAP, Ranson's, APACHE-II, and CTSI scores in predicting organ failure, complications, and mortality in acute pancreatitis[J].Am J

Gastroenterol. 2010; 105: 435-441.DOI:10.1038/ajg.2009.622.

16. Qiu L,Sun RQ,Jia RR,et al.Comparison of Existing Clinical Scoring Systems in Predicting Severity and Prognoses of Hyperlipidemic Acute Pancreatitis in Chinese Patients: A Retrospective Study[J].Medicine (Baltimore) . 2015;94:e957.DOI:10.1097/MD.0000000000000957
17. Aoun E,Chen J,Reighard D,et al.Diagnostic accuracy of interleukin-6 and interleukin-8 in predicting severe acute pancreatitis: a meta-analysis[J].Pancreatology.2009;9:777-785.DOI:10.1159/000214191
18. Balthazar EJ.Acute pancreatitis: assessment of severity with clinical and CT evaluation[J]. Radiology.2002;223:603-613.DOI:10.1148/radiol.2233010680
19. Yang L,Liu J,Xing Y,et al.Comparison of BISAP, Ranson, MCTSI, and APACHE II in Predicting Severity and Prognoses of Hyperlipidemic Acute Pancreatitis in Chinese Patients[J]. Gastroenterol Res Pract.2016;2016: 1834256. DOI:10.1155/2016/1834256

Tables

Table 1 Comparison of clinical features between two groups

Features	MAP	MSAP and SAP	P value
	n=133	n=34	
Gender,%	90(67.7)	24(70.6)	0.74
Male	43(32.3)	10(29.4)	
Female			
Age,years	39.8±11.0	39.7±11.0	0.95
ALT(U/L)	29.1±20.0	27.0±20.1	0.59
AST(U/L)	27.0±20.1	32.1±31.8	0.49
TG(mmol/L)	13.1±8.2	23.3±11.9	0.00
TC(mmol/L)	8.5±4.0	12.0±8.9	0.03
Amylase(U/L)	304.7±336.7	349.2±306.2	0.46
BISAP	0.9±0.8	2.5±0.9	0.00
MCTSI	2.9±1.4	4.8±1.8	0.00
Hospitalization days	8.3±2.7	13.0±4.8	0.00
Local complication,%			
0	94(70.7)	9(26.5)	0.00
1	39(29.3)	25(73.5)	
Hypertension,%			
0	105(78.9)	24(70.6)	0.30
1	28(21.1)	10(29.4)	
Hyperuricemia,%			
0			0.25
1	106(79.7)	30(88..2)	
	27(20.3)	4(11.8)	
Type 2 diabete,%			0.69
0	87(65.4)	21(61.8)	
1	46(34.6)	13(38.2)	
Fatty liver,%			
0	66(49.6)	6(17.6)	0.01
1	67(50.4)	28(82.4)	

Alanine aminotransferase ALT,Aspertate aminotransferase AST,Triglycerides TG,Total cholesterols TC,Bedside index for severity in acute pancreatitis BISAP,Modified CT severity index MCTSI,Mild acute pancreatitis MAP,Moderately severe acute pancreatitis MSAP,Severe acute pancreatitis SAP,0=no of cases,1=yes of cases

Table2 Analysis between BISAP and MCTSI in predicting severity of HLAP

Scoring system	MAP	MSAP and SAP	P value
	n=133	n=34	
BISAP			
≥3	6(4.5%)	25(73.5%)	0.00
<3	127(95.5%)	9(26.5%)	
MCTSI			
≥4	53(39.8%)	27(79.4%)	0.00
<4	80(60.2%)	7(20.6%)	

Bedside index for severity in acute pancreatitis BISAP,Modified CT severity index MCTSI,Hyperlipidemic acute pancreatitis HLAP,Mild acute pancreatitis MAP,Moderately severe acute pancreatitis MSAP,Severe acute pancreatitis SAP

Table3 Analysis between BISAP and MCTSI in predicting local complication of HLAP

Scoring system	No Local complication	Local complication	P value
	n=103	n=64	
BISAP			
≥3	7(6.8%)	24(37.5%)	0.00
<3	96(93.2%)	40(62.5%)	
MCTSI			
≥4	22(21.4%)	58(90.6%)	0.00
<4	81(78.6%)	6(9.4%)	

Bedside index for severity in acute pancreatitis BISAP, Modified CT severity index MCTSI,Hyperlipidemic acute pancreatitis HLAP

Table4 Comparision between BISAP and MCTSI in predicting severity and local complications of HLAP

Scoring system	sensitivity(%)	specificity(%)	PPV(%)	NPV(%)	Youden index	AUC
MSAP and SAP						
BISAP	73.5	95.5	80.6	93.4	0.69	0.89
MCTSI	79.4	60.2	33.8	92.0	0.40	0.78
Local complication						
BISAP	37.5	93.2	77.4	70.6	0.31	0.73
MCTSI	90.1	78.6	72.5	93.1	0.69	0.87

Bedside index for severity in acute pancreatitis BISAP, Modified CT severity index MCTSI,Hyperlipidemic acute pancreatitis HLAP,Moderately severe acute pancreatitis MSAP,Severe acute pancreatitis SAP,Positive predictive value PPV,Negative predictive value NPV,Area Under the Curve AUC

Figures

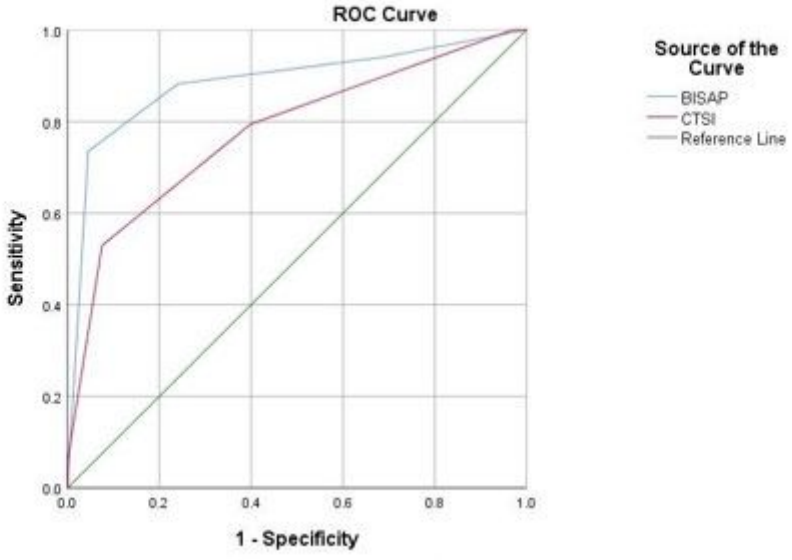

Figure 1

ROC curve of BISAP and MCTSI about the severity of HLAP

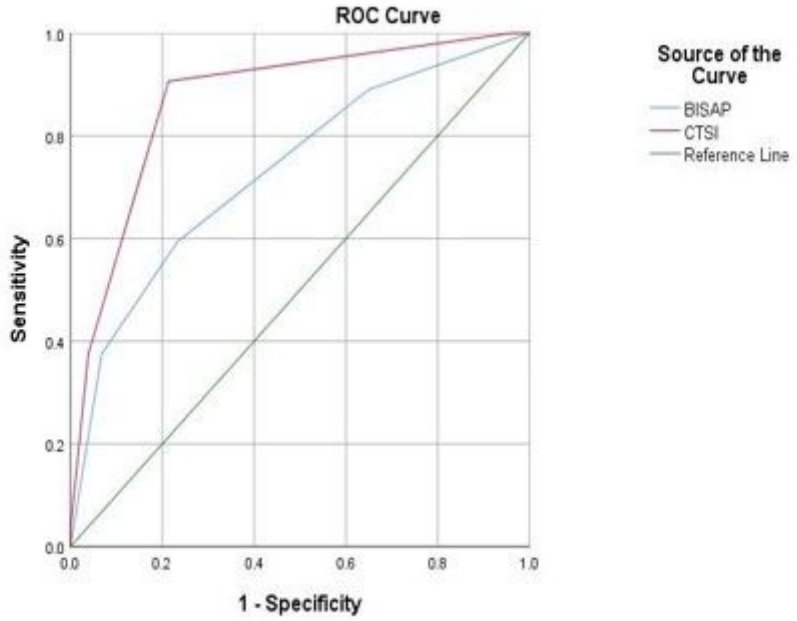

Figure 2

ROC curve of BISAP and MCTSI about local complications of HLAP

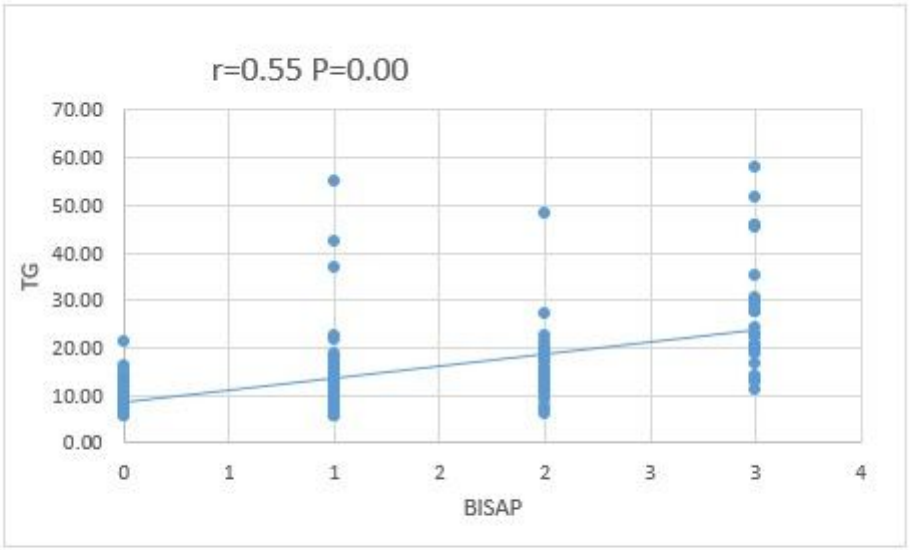

Figure 3

Correlation between BISAP and TG of HLAP