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Original Research Article

Improving outcome in perforated peptic ulcer emergency surgery by Boey scoring

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ABSTRACT

Background: since perforation occurs in 2% of patients of peptic ulcer disease hence perforated peptic ulcer is one of the most common indications for emergency gastrointestinal surgery. Delayed treatment, older age, presence of shock on admission and American Society of Anesthetisiologist status (ASA) are the risk factors for prediction of complication and mortality. A delay of more than 24 hours increases the lethal status seven to eight fold and complications rate by three folds.
Methods: A study was undertaken with 50 diagnosed patients of peptic ulcer disease to predict their morbidity and mortality using risk stratified Boey Score.
Results: Perforated peptic ulcer is more common in males with younger age group and risk significantly increases with increase in Boey score. Pulmonary complications are commonest followed by surgical site infection. The accuracy in predicting morbidity and mortality with Boey score was 88.70%and 84.90% respectively.
Conclusions: Boey score is a simple and precise predictor of post-operative status of the patients with perforated peptic ulcer patients. Pre-operative prediction with Boey score goes a long way in reducing mortality and morbidity and requires timely management with aggressive treatment in such stratified high risk patients.

Keywords: Perforated peptic ulcer, Perforated peptic ulcer, Receiver operating characteristic, Area under curve

INTRODUCTION

To facilitate the management of perforated peptic ulcer and to improve the outcome it is important to stratify the patients based on prediction of morbidity and mortality. It is very important that high risk patients receive more appropriate treatment and greater intensive care. Several risk scores for prediction of outcome of peptic ulcer patients have been developed.[13-19] APACHE score (Acute Physiologic And Chronic Health Evaluation, SAPS (Simplified Acute Physiology Score), MOF Score (Multi Organ Failure) MPI score (Mannheim Peritonitis Score) and other scoring system are cumbersome in difficult to use in all emergency setup and many of them incorporate the intra operative and post-operative status as well. Since perforation occurs in 2% of patients of peptic ulcer disease hence perforated peptic ulcer is one of the most common indications for emergency gastrointestinal surgery.[1] Delayed treatment, older age, presence of shock on admission and American Society of Anesthetisiologist status (ASA) are the risk factors for prediction of complication and mortality.[3-8] A delay of more than 24 hours increases the lethal status seven to eight fold and complications rate by three folds.[9] In 1987 Boey et al introduced the Boey scoring system which included three independent risk factors i.e. duration of perforation, co morbid disease and preoperative shock which makes the scoring system very simple and easy to implement in all emergency situation.[14] Hence this prospective study was planned to evaluate the performance of Boey Score in

risk stratified morbidity and mortality prediction in perforated peptic ulcers.

METHODS

A prospective study was undertaken to predict the mortality and morbidity of perforated peptic ulcer by risk stratified scoring using Boey scoring system at Department of Surgery, Safdarjung Hospital and Vardhman Mahaveer Medical College, New Delhi between 2011-2015. All patients presenting to surgical emergency diagnosed as perforated peptic ulcer was taken into study but patients below 12 years of age, with malignant gastric perforation, Giant perforations, primary peritonitis of other causes as corrosive acid perforation, associated traumatic injury to other organs and those not able to follow up were excluded from study.

A detailed history of dyspepsia, epigastric pain, drug intake of NSAIDS, waxing and waning of symptoms with smoking and alcohol intake were all taken into consideration. Any existing co morbid condition as diabetes, tuberculosis, respiratory, cardiovascular or renal diseases were taken for prediction of outcome. Detailed physical examination and hydration status were given due consideration and per abdominal examination including tenderness guarding rigidity and rebound tenderness were recorded at the time of admission.

Emergency investigation included complete haemogram, random blood sugar, Serum electrolytes, blood urea and serum creatinine and radiological investigation of X ray Chest, X ray abdomen along with USG abdomen and ECG were recorded prior to patient taken up for definitive surgical procedure. All patients with perforated peptic ulcer patients were divided into four groups based on Boey scoring group.

- Group 1 had no risk factor with score of Zero (0).
- Group 2 had one risk factor with score of One (1).
- Group 3 had two risk factor with score of Two (2).
- Group 4 had all three risk factor with score of Three (3).

Actually Boey's scoring system highlights that scoring is proportional to risk factors predicting morbidity and outcome in operated perforated peptic ulcer patients Duration of perforation was determined by time interval between the onset of symptoms of severe abdominal pain and arrival time in the hospital. Concomitant severe medical illness included Heart disease, Lung disease, liver failure, diabetes, renal failure, immune compromised patients. Shock was defined as persistent hypotension with,

- Systolic BP less than 90 mm of Hg
- Mean arterial pressure less than 60
- Reduction in Systolic BP more than 40 mm of Hg from baseline.

Risk factors included

No of hours since perforation

- <24 hours (less than) Score 0
- >24 hours (more than) Score 1

Concomitant severe medical illness

- Absent score 0
- Present score 1

Preoperative shock

- Absent score 0
- Present score 1

All patients with peptic ulcer perforation were treated with exploratory laprotomy and through peritoneal lavage and modified Grahams patch repair and placement of drains under general anesthesia. All 50 patients in our study were amenable to modified Grahams patch repair as size of perforation ranged from $0.5cms^{-1}$.cms. Antibiotics were given to all patients post operatively. Anti-helicobacter therapy with lansoprazole (30 mg) + tinidazole (500 mg) + clarithromycin (250 mg BD dose) was given for fourteen days once patient started oral feeding. All patients were followed up fortnightly for six months and then quarterly for two years and assessed for their morbidity and recurrence of symptoms following completion of helicobacter pylori treatment .Patients demographic profile, Boey score of three independent risk factors, operative details and surgical outcomes were analyzed .

Mortality was defined as death during the hospital stay.

Morbidity was assessed in terms of

Length of hospital stay

Post-operative complications

- Burst abdomen
- Surgical site infection
- Leak at the repaired site
- Pulmonary complications pneumonia, atelectasis, pleural effusion.

The data thus collected was transferred to computer based spread sheet and analyzed using SPSS statistical software version. The association of various levels of Boey with mortality incidence and morbidity occurrences was tested using Chi Square Test for trend analysis .Logistic regression analysis and Receiver Operating Characteristics (ROC) curve analysis were used to estimate the predictive ability of Boey's score in assessing the post-operative mortality and morbidity.

The area under the ROC Curve (AUC) indicated the probability of concordance between predicted probability of post-operative morbidity or mortality and the actual post-operative state. The area ranges from 0.50 for chance performance to 1 for perfect prediction P value less than /equal to 0.05 was considered as statically significant.

RESULTS

Table 1: Distribution of mean age and standard deviation of males and females.

Sex	No.	Minimum	Maximum	Mean	Standard Deviation	Standard error of mean
Male	46	21	64	38.26	10.417	1.536
Female	4	35	37	36.25	0.957	0.479
Total	**50**	**21**	**64**	**38.10**	**10.001**	**1.414**

Mean age was 38.10 years and maximum patients belonged to age group of 31-40 years of age. The age distribution in years is shown in Table 2.

Table 2: Age distribution in years.

Age in years	No. of patients	Percentage
<30 years	12	24
31-40 years	21	42
41-50 years	10	20
51-60 years	6	12
>60 years	1	2
Total	**50**	**100**

Table 3: Sex distribution.

Gender	No. of patients	Percentage
Male	46	92
Female	4	8
Total	50	100

Table 4: Distribution of patients based on duration of perforation on arrival in hospital.

Duration	No. of patients	Percentage
>24 hours	21	42
<24 hours	29	58
Total	**50**	**100**

Table 5: Distribution of patients based on comorbid conditions.

Comorbid condition	No. of patients	Percentage
COPD	9	18
DM	2	4
COPD + DM	1	2
Absent	38	76
Total	**50**	**100**

Duration of perforation was more than 24 hours in 21 patients i.e. 42%.

Co morbid conditions were present in 12 (24%) out of 50 patients 18% had COPD 45 had diabetes mellitus and both combined diabetes and COPD were present in 2% of patients. Preoperative Shock was present in 18patients (36%) of patients.

Table 6: Distribution of patients based on presence of preoperative shock.

Pre operative shock	No.of patients	Percentage
Present	18	36
Absent	32	64
Total	**50**	**100**

Distribution of patients using Boey's score

On the basis of three risk factors (duration of perforation, co-morbid condition, preoperative shock), all patients were categorized into 4 groups. first group were patients with no risk factor and Boey's score was 0 and there were20 patients (40%) . Second group were with one risk factor with Boey's score of 1 consisted of 14 patients (28%). Third group was with any two risk factors and with Boey's score of 2included 11 patients (22%). The Fourth group with all three risk factors with Boey's Score of 3included 5 patients (10%).

Table 7: Distribution of patients using Boey score.

Group	Boey's score	Risk factor	No. of patients	Percentage
1	0	No risk factor	20	40
2	1	One risk factor	14	28
3	2	Two risk factor	11	22
4	3	Three risk factor	5	10
		Total	**50**	**100**

Perforation site the most site of perforation was pre pyloric 31 patients (62%) and second most commonest

site was pyloric in 13 patients (26%) followed by first part of duodenum in 6 patients (12%).

Table 8: Distribution of patients according to site of peptic ulcer perforation.

Perforation Site	No. of patients	Percentage %
Prepyloric	31	62
Pyloric	13	26
Duodenum first part	6	12
Total	**50**	**100**

Surgery exploratory laparotomy with through peritoneal lavage and repair of peptic ulcer was done using Modified grahams omental patch and placement of drains formed the mainstay of the treatment in all patients .Fortunately all 50 patients in our study had perforation size ranging from 0.5-1 cm which were very much amenable to Graham's Patch repair.

Complications

Pulmonary complications were present in all groups of patients stratified on the basis of Boey's score. Overall 30% of patients had pulmonary complication. In patients with Boey's score 0 group pulmonary complications were found in 2 patients (10%). In Boey's score of 1 there were 3 patients (21.4%) with Boey's score of 2 pulmonary complications were in 6 patients (54.5%). In Boey's score of 3 four patients (80%). Comparing the incidence of pulmonary complications (percentage of patients with pulmonary complication) in different Boey's group an increasing trend with statically significant p value equal to 0.004 on chi square test were noted.

Table 9: Incidence of pulmonary complications in patients categorized on basis of Boey score.

Boey score	Present (n%)	Absent n (%)	Total n (%)
0	2 (10%)	18 (90%)	20 (100%)
1	3 (21.4%)	11 (78.6%)	14 (100%)
2	6 (54.5%)	5 (45.5%)	11 (100%)
3	4 (80%)	1 (20%)	5 (100%)
Total	**15 (30%)**	**35 (70%)**	**50 (100%)**

Table 10: Incidence of pulmonary complication.

Boey score	Present (n %)	Absent n (%)	Total n (%)
0	2 (10%)	18 (90%)	20 (100%)
1	3 (21.4%)	11 (78.6%)	14 (100%)
2	6 (54.5%)	5 (45.5%)	11 (100%)
3	4 (80%)	1 (20%)	5 (100%)
Total	**15 (30%)**	**35 (70%)**	**50 (100%)**

Surgical site infection

No surgical site infection was observed in patients with Boey's score 0 groups. Overall surgical site infection was noted in 14 patients accounting for (28%) patients with surgical site infection. With Boey score of 1 group we found 4 patients (28.6%) and in Boey score 2 group 7 (63.6%) patients and in Boey score 3 in group 3 we had 3 patients (60%) Comparing the incidence of surgical site infection of different Boey group an increasing trend is seen with increasing Boey score except in score 3 which might be because of less no of patients with high mortality and this is statically significant with p value equal to 0.001on chi square test.

Table 11: Surgical site infection in different Boey group..

Boey Score	Present n (%)	Absent n (%)	Total (n %)
0	0 (0%)	20 (100%)	20 (100%)
1	4 (28.6%)	10 (71.40%)	14 (100%)
2	7 (63%)	4 (36.4%)	11 (100%)
3	3 (60%)	2 (40%)	5 (100%)
Total	14 (28%)	36 (72%)	50 (100%)

Burst abdomen

There were no patients of burst abdomen in Boey's score 0 group. Boey's score 1 group had one patients (7.1%) and Boey's score 2 group had 6 patients (54.5%) and Boey's score 3 group had 3 patients (60%) had burst abdomen. Overall there were 10 patients (20%) who had burst abdomen showing an increasing trend which is statically highly significant with p value equal to 0.000 on chi square test.

Table 12: Incidence of burst abdomen in different Boey group.

Boey score	Present n%	Absent	Total
0	0 (0%)	20 (100%)	20 (100%)
1	1 (7.1%)	13 (92.2%)	14 (100%)
2	6 (54%)	5 (45.5%)	11 (100%)
3	3 (60%)	2 (40%)	5 (100%)
Total	**10 (20%)**	**40 (80%)**	**50 (100%)**

Table 13: Incidence of leak at repaired Site in different Boey group.

Boey Score	Present n (%)	Absent n (%)	Total n (%)
0	0 (0%)	20 (100%)	20 (100%)
1	0 (0%)	14 (100%)	14 (100%)
2	2 (18.2%)	9 (81.8%)	11 (100%)
3	1 (3%)	4 (80%)	5 (100%)
Total	**3 (6%)**	**47 (94%)**	**50 (100%)**

Leak at repaired site

There was no leak at repaired site in Boey's score 0 and 1 group. It was observed that 2 patients (18.2%) in Boey's score 2 and one patients (20%) in Boey score 3 group had leak. Overall 3 patients (6%) had leak at repaired site in different groups and p value is 0.078 on chi square test which is statically significant.

Overall complication

The most complication was pulmonary complication seen in 15(30%) of patients followed by surgical site infection in 14 (28%) of patients and burst abdomen in 10 (20%) of patients and least common was the leak at the repaired site with 3 patients (6%).

Length of hospital stay

The duration of hospital stay varied from minimum of 3 days and maximum of 28 days and one patient died on third post-operative day because of severe post-operative respiratory complications. Mean length of hospital stay was 10.12 days with standard deviation of 5.619 days and standard error of mean 0.765 days.

On comparing the length of hospital stay in different Boey's Group p value comes out to be 0.000 on chi square test which is statically significant which indicates that length of stay increases as Boey's score increases.

Table 14: Distribution of various complications.

Complication	No. of patient	Percentage (%)
Pulmonary	15	30
Surgical site infection	14	28
Burst Abdomen	10	20
Leak at repaired site	3	6

Table 15: Length of hospital stay (in days) in each group of Boey Score.

Boey's score	No of patients	Minimum (Days)	Maximum (Days)	Mean	Standard deviation	Standard Error of mean
0	20	6	14	6.85	2.159	0.483
1	14	7	15	9.71	2.555	0.683
2	11	7	28	15.64	7.567	2.281
3	5	3	21	12.20	7.563	3.382
Overall	50	3	28	10.12	5.619	0.795

Morbidity Included pulmonary complications, surgical site infection, burst abdomen, leaks at repaired sites.

Overall the morbidity noted in was 19 (38%) patients. Comparing with different Boey's score an increasing trend was noticed with increase in Boey's score with p value equal to 0.003 on chi square test i.e. p less than equal to ≤ 0.005 Boey's score 0 group the morbidity was in 2 (10%) patients, 6 patients (42.9%) in group 2 with score one and 7 patients (63.6%) in score 2 group and lastly 4 patients (80%) in score 3 group.

Table 16: Morbidity in each group in Boey's score.

Boey's score	Present n (%)	Absent n (%)	Total (n %)
0	2 (10%)	18 (90%)	20 (100%)
1	6 (42%)	8 (57.1%)	14 (100%)
2	7 (63.6%)	4 (36.4%)	11 (100%)
3	4 (80%)	1 (20%)	5 (100%)
Overall	19 (38%)	31 (62%)	50 (100%)

Mortality

Mortality occurred in only one patient (7.1%) in Boey Score 1 group 4 patients (36.4%) in Boey score group 2 and 2 patients (40%) in group with Boey Score 3 group expired. Overall there were 7 patients (14%) who expired. Comparing the incidence of mortality with score pattern we notice an increasing trend as Boey score increases and this is statically significant with p value equal to 0.011 on chi square test.

Table 17: Mortality in each group in Boey score.

Boey Score	Present (n%)	Absent (n%)	Total (n%)
0	0 (0%)	20 (100%)	20 (100%)
1	1 (7.1%)	13 (92.9%)	14 (100%)
2	4 (36.4%)	7 (63.6%)	11 (100%)
3	2 (40%)	3 (60%)	5 (100%)
Overall	7 (14%)	43 (86%)	50 (100%)

Causes of mortality

In our study 5 patients (10%) patients died of respiratory failure and one patient (2%) died of Myocardial

infarction and one patients (2%) died of septicemic shock.

Predictive ability of Boey score

The area under the receiver operating curve (AUC) indicates the concordance between the predicted probability of post-operative morbidity or mortality and the actual post-operative state. This area ranges from 0.50 for chance performance and 1.00 for perfect prediction. with 95% confidence interval (CI). In our study the positivity of logistic regression coefficient of Boey's score revealed that the risk increases with Boey's score. The accuracy of Boey's score in predicting morbidity and mortality was shown in terms of AUC (95% CI) which was 0.887 (0.790-0.985) for morbidity and 0.849 (0.730-0.968) for mortality which is a near perfect prediction.

Table 18: Distribution of cause of mortality in various groups of Boey score.

Causes	No. of patients (n)	Percentage (%)
Respiratory Failure	5	10
Myocardial infarction	1	2
Septicemic shock	1	2
Total	**7**	**14**

Table 19: Area under ROC curve (AUC)for prediction of morbidity and mortality.

Score	Prediction of probability (morbidity) AUC (95% CI)	Prediction of Mortality AUC (95%CI)
Boey Score	0.887(0.790-0.985)	0.849 (0.730-0.968)

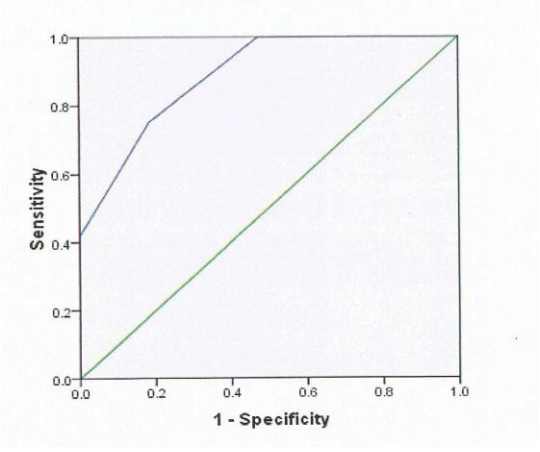

Figure 1: Area under ROC curve (AUC) for morbidity.

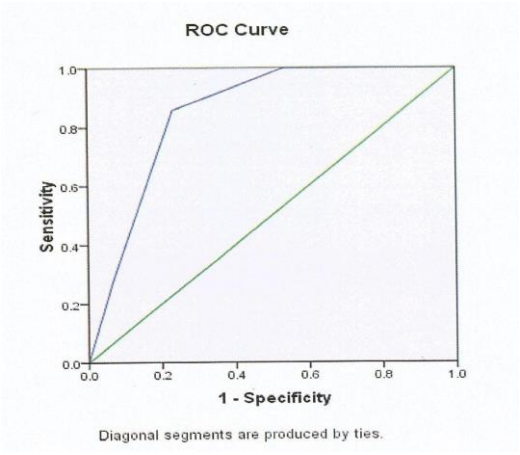

Figure 2: Area under ROC curve (AUC) for mortality.

DISCUSSION

Perforated peptic ulcer is a common emergency surgery. Patients demographic profile along with 3 independent risk factor included in Boey's scoring system (duration of perforation, co morbid conditions, preoperative shock) and operative details, surgical outcomes (complications, morbidity, mortality, length of hospital stay were analyzed and evaluation of scoring system was done in predicting morbidity and mortality among patients with perforated peptic ulcer. It was observed that PPU was common in males and also occurred in much younger age group .which is in conformity with various study by other investigators.[14-16,32,52] This may be attributed to demographic profile of smoking, alcoholic beverages in younger age group in men thus increasing the risk of PPU in young adults. However, PPU rising in elderly which is attributed to increasing use of NSAIDS in this population.[53,54] In our study pre pyloric perforation was commonest site while other investigators had reported first part of duodenum as common site for ulcer location.[15,51,55] However all share the common patho-physiology with acid hyper secretion and high prevalence of helicobacter pylori infection.[56,57]

In our study Modified Graham's patch with a pedicle omental patch repair was done in all cases with routine eradication of helicobactor pylori infection to avoid recurrences and re-perforation.[1,11,12] This empirical treatment was based on assumption that prevalence of *Helicobactor pylori* infection in PPU is very high (56-80%).[2,11,58]

Though in our study the overall morbidity was (38%), pulmonary complication (30%), wound infection (28%) which was attributed to the fact that all cases were actually upper abdominal surgery restricting vital capacity in early post-operative periods in spite of analgesia support and thus adding to pulmonary complications.[59] Wound infection rate was 28% in our study while an infection rate of 15-40% and overall post-

operative complication in various studies ranged from 17-63%.[60-63]

Though mortality figure in our patients was 14% over a period of 30 days but it escalated to 40 % with Boey score of 3 where all risk factors were present. Though overall mortality after surgery for PPU ranged from 6-14%and escalates to 30-60% with Boey's score of 2 or more.[15,26,52] Mortality of 36.4%was noted in our study with Boey's score of 2 and 40% with Boey's score 3 while Varut Lohsiriwat et al reported mortality of 33% for Boey's score 2 and 38% for Boey's score 3.[32] Boey's et al published results in with 100% mortality in Boey's score of 3 in PPU.[14] Improved outcome by risk stratification dividing patients into high and low risk groups with improving critical care management are contributory factors for better outcome while old age and delay in treatment and definitive operation adds to mortality risk.[52] K Soreide et al confirmed that adherence to perioperative strategies, the morbidity and mortality can be reduced.[65] Kenneth Thorsen et al stated that combination of six factors of age, active cancer ,hyperbilirubinaemia, hypoalbuminemia, elevated creatinine, and delay of surgery beyond 24 hours added to mortality.[66]

Our study reaffirmed the accuracy of Boey's, scoring system in predicting mortality rate 0%,7.1%, 36.4% and 40% for Boey's, score of 0,1,2,3 respectively with (p value 0.011) and morbidity was 10%, 42.9%, 63.6% and 80% with Boey's, Score of 0,1,2,3 respectively with (p value 0.003). A retrospective study by Varut Lohsiriwat et al showed mortality rate was 1%,8%,33%and 38% respectively for Boey's score of 0,1,2 and 3 respectively (p value<0.001) and morbidity rates was 11%,47%,75%,77% for Boey's score of 0,1,2 and 3 respectively (p value <0.001).[32] A seminal study by Boey's et al showed that patients with score of 0,1,2 and 3 had mortality rates of 0%,10%,45.5% and 100%.[15] A progressive rise in mortality rate was reported in other studies.[26,64] Though several scoring system had been reported to predict mortality and morbidity this present study can help as an added tool to predict poor surgical outcomes.[14-19] the accuracy of Boey's score in predicting morbidity and mortality was determined by area under curve ie. AUC (95%CI) which was 0.887 (0.790-0.985) for morbidity and 0.849 (0.730-0.968).

CONCLUSION

Peptic ulcer perforation comprises one of the most common surgical emergency procedure in our country. It has mortality incidence of ranging between 6%-14%.[15,26,52] Thus it is imperative to identify high risk group patients subjecting them to risk analysis and planning their treatment as per need base and intensive care monitoring.

The present prospective study was designed and conducted in 50 patients presenting the peptic ulcer perforation and risk stratified using Boey's scoring system. All underwent emergency laparotomy with Graham's omental patch repair. A statistical analysis of the post-operative complications, morbidity and mortality was done as Boey's groups. An attempt was made to evaluate the Boey's score to predict the morbidity and mortality in patients with perforated ulcer.

In our study we found that perforated peptic ulcer was more common in males than in females and that men in this series were younger than the women which are also in conformity with the various studies available in the literature. Prepyloric region was the most common site of perforated peptic ulcer. Pulmonary complications were the most common complication in our study followed by surgical site infections. In our study, the positivity of logistic regression coefficient of Boey's score revealed that the risk increasing along with the score. The accuracy of Boey's score in predicting morbidity and mortality in patients with perforated peptic ulcer was 88.7% and 84.9% respectively which is near perfect prediction.

Perforated peptic ulcer is a fairly common serious surgical condition requiring emergency surgical management. Primary closure of the perforation with Graham's omental patch formed the mainstay of operative procedure in our study group as the size of the perforation in all the patients ranged between 0.5-1 cm. Mortality rate was 14% and morbidity rate being 38%. A near perfect preoperative prediction certainly goes a long way in reducing the morbidity and mortality in such cases with timely institution of more aggressive treatment in such stratified and predicted high risk patient groups. Thus the Boey's scoring system served as a simple precise predictor of postoperative mortality and morbidity.

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