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Comparison of Scoring Systems (Boey's, Mannheim Peritonitis Index (MPI), Acute Physisiology and Chronic Health Evaluation Ll (APACHE II) And APACHE III) in Predicting Mortality in Patients of Secondary Peritonitis

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Abstract: Secondary peritonitis following an intraperitoneal source is usually from a perforated hollow viscus [1]. Despite advanced techniques in diagnosis, surgical techniques, antimicrobial therapy and intensive care support secondary peritonitis remains a potentially fatal affliction. Several scoring systems were developed to evaluate and compare outcome and treatment [2-4]This prospective study was conducted over a period of 10 months on 200 patients who were admitted in government medical college and hospital, sector 32, Chandigarh, India as a case of non- traumatic perforation (secondary peritonitis). History was noted and scores were calculated on the basis of preoperative investigations and intraoperative findings. Comparison was made using scores and post operative outcome. Aim of this study was to compare and bring most useful scoring system for prediction of outcome in secondary Peritonitis. Result in predicting mortality came out to be APACHE III>APACHE II> MPI > BOEY'S SCORE and hence it was concluded that APACHE III is most accurate in predicting post-operative mortality.
Keywords: Secondary peritonitis, intraperitoneal, viscus, affliction.

INTRODUCTION

Hippocrates first described peritonitis as one with cold clammy skin, sunken eyes, thready irregular pulse and drawn anxious facies (Hippocratic facies) [1]. Peritonitis is inflammation of peritoneum that is generalised or locaized. Three types of peritonitis are: - primary or spontaneous bacterial peritonitis (no visceral perforation). Secondary peritonitis which of most common type and is due to hollow viscus perforation.

Tertiary peritonitis is low grade of persistent infection following treatment failure to secondary peritonitis [2-4].

Boey's scoring system (table 1) was introduced in 1982 and is considered to be accurate and valid for gastroduodenal (peptic ulcer) perforations [10]. Total score is 0 to 3.

Mannheim peritonitis index (MPI) (table2) was introduced by Wacha *et al*. in 1986 with analysis of 17 risk factors which were later reduced to 8. It is a scoring system based on both preoperative and intraoperative findings [9]. Range is from 0 – 57.

Table-1

Concomitant severe medical illness
Preoperative shock
Duration of perforation > 48 hours
Score: 0–3 (Each factor scores 1 point if positive

Table-2

RISK FACTOR	SCORES
Age > 50 years	5
Female sex	5
Organ failure*	7
Malignancy	4
Preoperative duration of peritonitis > 24 h	4
Origin of sepsis not colonic	4
Diffuse generalized peritonitis	6
Exudate • Clear • Cloudy, purulent • Fecal	 0 6 12

*** Organ failure is defined as**

- Kidney failure = creatinine level > 177 umol/L or urea level > 167mmol/L or oliguria < 20ml/hour;
- Pulmonary insufficiency = PO2 < 50 mmHg or PCO2 > 50 mmHg;
- Intestinal obstruction/paralysis > 24hours or complete mechanical ileus
- Shock hypodynamic or hyperdynamic

Table-3

PHYSIOLOGIC VARIABLE	HIGH ABNORMAL RANGE					LOW ABNORMAL RANGE			
	+4	+3	+2	+1	0	+1	+2	+3	+4
TEMPERATURE – rectal (°C)	≥41°	39°-40.9°		38.5°-38.9°	36°-38.4°	34°-35.9°	32°-33.9°	30°-31.9°	≤29.9°
MEAN ARTERIAL PRESSURE – mm Hg	≥160	130-159	110-129		70-109		50-69		≤49
HEART RATE (ventricular response)	≥180	140-179	110-139		70-109		55-69	40-54	≤39
RESPIRATORY RATE – (non-ventilated or ventilated)	≥50	35-49		25-34	12-24	10-11	6-9		≤5
OXYGENATION: A-aDO_2 or PaO_2 (mm Hg) a. FIO_2 ≥ 0.5 record A-aDO_2	≥500	350-499	200-349		<200				
b. FIO_2 < 0.5 record only PaO_2					PO_2 > 70	PO_2 61-70		PO_2 55-60	PO_2 < 55
ARTERIAL pH	≥7.7	7.6-7.69		7.5-7.59	7.33-7.49		7.25-7.32	7.15-7.24	< 7.15
SERUM SODIUM (mMol/L)	≥180	160-179	155-159	150-154	130-149		120-129	111-119	≤110
SERUM POTASSIUM (mMol/L)	≥7	6-6.9		5.5-5.9	3.5-5.4	3-3.4	2.5-2.9		< 2.5
SERUM CREATININE (mg/100 ml) (Double point score for **acute** renal failure)	≥3.5	2-3.4	1.5-1.9		0.6-1.4		< 0.6		
HEMATOCRIT (%)	≥60		50-59.9	46-49.9	30-45.9		20-29.9		<20
WHITE BLOOD COUNT (total/mm3) (in 1,000s)	≥40		20-39.9	15-19.9	3-14.9		1-2.9		<1
GLASGOW COMA SCORE (GCS): Score = 15 minus actual GCS									
A Total ACUTE PHYSIOLOGY SCORE (APS): Sum of the 12 individual variable points									
Serum HCO_3 (venous-mMol/L) [Not preferred, use if no ABGs]	≥52	41-51.9		32-40.9	22-31.9		18-21.9	15-17.9	<15

B AGE POINTS:
Assign points to age as follows:

AGE(yrs)	Points
≤44	0
45-54	2
55-64	3
65-74	5
≥75	6

C CHRONIC HEALTH POINTS
If the patient has a history of severe organ system insufficiency or is immuno-compromised assign points as follows:
a. for nonoperative or emergency postoperative patients – 5 points
or
b. for elective postoperative patients – 2 points

DEFINITIONS
Organ Insufficiency or immuno-compromised state must have been evident **prior** to this hospital admission and conform to the following criteria:

LIVER: Biopsy proven cirrhosis and documented portal hypertension; episodes of past upper GI bleeding attributed to portal hypertension; or prior episodes of hepatic failure/encephalopathy/coma.

CARDIOVASCULAR: New York Heart Association Class IV.

RESPIRATORY: Chronic restrictive, obstructive, or vascular disease resulting in severe exercise restriction, i.e., unable to climb stairs or perform household duties; or documented chronic hypoxia, hypercapnia, secondary polycythemia, severe pulmonary hypertension (>40mmHg), or respirator dependency.

RENAL: Receiving chronic dialysis.

IMMUNO-COMPROMISED: The patient has received therapy that suppresses resistance to infection, e.g., immuno-suppression, chemotherapy, radiation, long term or recent high dose steroids, or has a disease that is sufficiently advanced to suppress resistance to infection, e.g., leukemia, lymphoma, AIDS.

APACHE II SCORE
Sum of A + B + C :

A APS points _____

B Age points _____

C Chronic Health points _____

Total APACHE II _____

Acute physiology and chronic health evaluation (APACHE) was introduced in 1981 by William Knauss which was later modified to APACHE II in 1985(table 3) [17,18]. It consists of 34 variables and range is from 0 – 60.

APACHE III (TABLE 4 a,b,c) was introduced in 1991 by adding 5 more variables and score range was from 0 – 299[18].

Table-4a: vital signs and laboratory tests

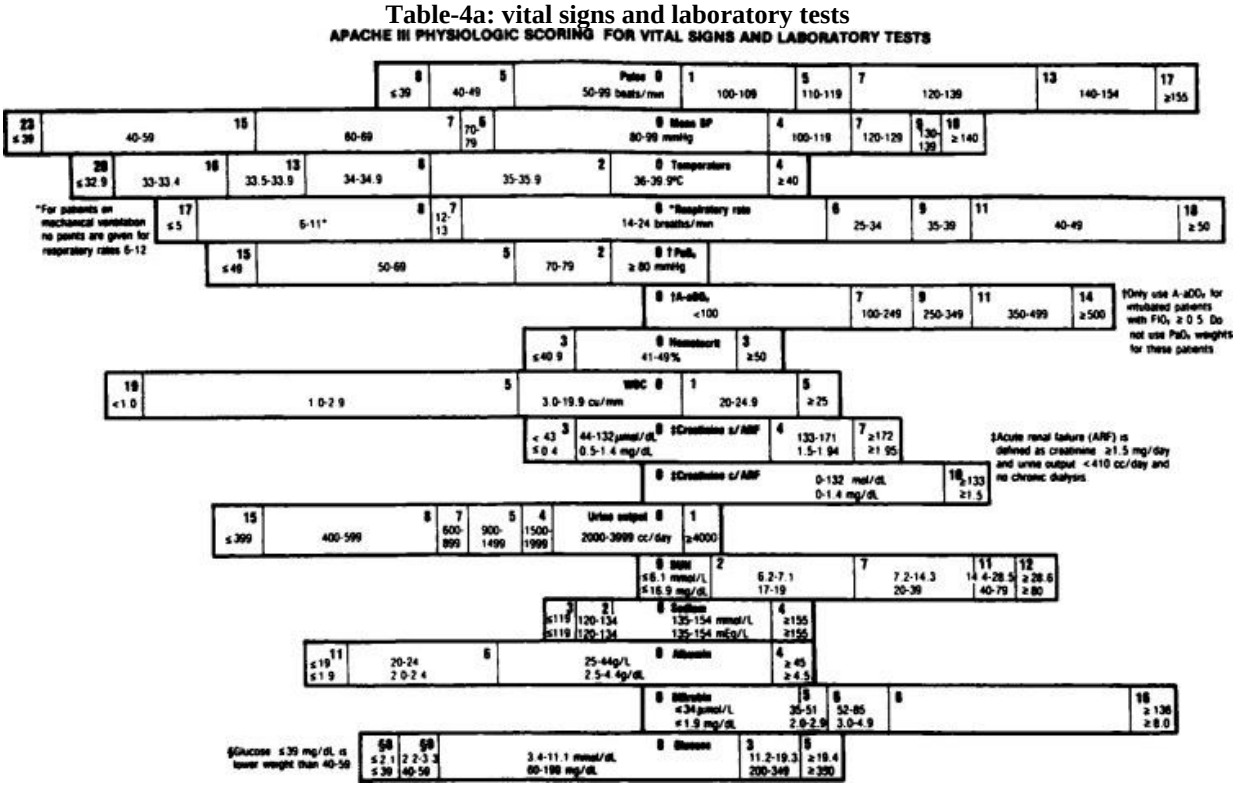

Table-4b: APACHE III: Physiologic scoring for neurologic abnormalities Eyes opens spontaneously or to painful/verbal stimulation

Verbal/Motor	Oriented/ Converses	Confused Conversation	Inappropriate words and incomprehensible sounds	No Response
Obeys Verbal Command	0	0	0	16
Localizes pain	0	0	0	16
Flexion withdrawal/ decorticate rigidity	0	0	24	33
Decerbrate rigidity/no response	0	0	29	48

Verbal/Motor	Oriented/ converses	Confused Conversation	Inappropriate words and incomprehensible sounds	No Response
Obeys Verbal Command	0	3	10	15
Localizes pain	3	8	13	15
Flexion withdrawal/ decorticate rigidity	3	13	24	24
Decerbrate rigidity/no response	3	13	29	29

Table-4c: APACHE III: Scoring for age and chronic health

	Points
Age in years	
<=44	0
45 – 59	5
60 – 64	11
65 – 69	13
70 – 74	16
75 – 84	17
>=85	23
Comorbid condition*	
AIDS	23
Hepatic failure	16
Lymphoma	13
Metastatic cancer	11
Leukemia/Multiple myeloma	10
Immunosupression	10
Cirrhosis	04

*excluded for elective surgery patients

AIM OF STUDY

To compare the four scoring systems and to assess best one for predicting mortality in secondary peritonitis

MATERIALS & METHOS

This prospective study was carried out on 200 patients of secondary nontraumatic peritonitis who were admitted to government medical college and hospital sector 32, chandigarh, India from January to october 2014. All patients were enrolled into study After taking written consent. History was noted and preoperative investigations required for scoring systems were sent and noted. Intraoperative findings along with procedure performed were noted. Patients were followed till final outcome (mortality or alive). Outcome was compared with initial allotted score and analysis was done using SPSS for windows (version 17.0; SPSS Inc., chicago, IL, USA).

RESULTS

Mean age =39.58 years
Range = 12-75 years
Mean age of survivors = 35.87 years
Mean age of non- survivors = 53.52 years

The chi square test value came out to be 0.292 and hence, duration of symptoms is insignificant in predicting mortality in secondary peritonitis (Table-7).

Table-5: Age distribution

Age groups	Number of patients(m:f)
10-19	20(17:3)
20-29	45(38:7)
30-39	30(27:3)
40-49	41(38:5)
50-59	36(31:5)
60-69	20(14:6)
70-79	8(4:4)

Table-6: Gender distribution

	Number of patients	percentage
females	33	16.5%
males	167	83.5%

Table-7: Duration of preoperative symptoms

Average (in total patients)	827/200 = 4.135 days
Duration in survivors	664/158 = 4.20 days
Duration in expired patients	163/42 = 3.88 days

Table-8: Sites of perforation

Sites of perforation	number
Gastroduodenal perforations:	89
- Prepyloric	54
- Duodenal	29
- Gastric	5
- pyloric	1
Small bowel perforations	71
- jejunum	2
- ileum	69
Appendix	21
Large bowel perforations	18
- caecum	5
- ascending colon	2
- transverse colon	6
- sigmoid colon	2
- rectum	3
Gall bladder	1

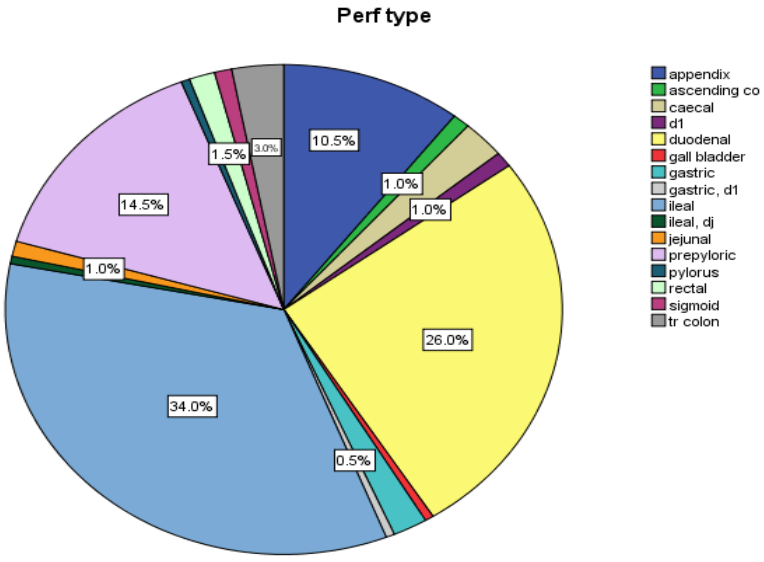

Fig-1

Table-9: Post-operative complications and associated morbidities noted

Complication	Frequency
Wound infection	72
Ventilator requirement	58
Wound dehiscence	33
Chest infections	24
Re exploration	11
Renal failure	11
Trachaeostomy	6
Cardiac failure	4
Obstruction	4
Bed sores	3
Deep(internal) haemorrhage	2
ICD insertion due to pleural effusion	2
Wound haemorrhage	1
Retracted stoma	1

Bleeding per rectum	1

Table-10: Indications of re-exploration

Indication	Number of patients	Operation performed	Deaths
Omental patch give way	3	1 -> tube duodenostomy with feeding jejunostomy 1 -> re repair	2
Anastomosis site disruption	3		1
Burst abdomen	2	Mass closure	0
Retracted mucus fistula	1	Re exploration and re fixing of mucus fistula	1
New perforation	1	proximal stoma formation and resection of bowel segment	0
Retracted stoma	1	Refashioning of stoma	1

Table-11: Duration of hospital stays (post-operative)

Average total stay (in 200 pts)	1998/200 = 9.99 days
Hospital stay in survivors	1493/158 = 9.45 days
Hospital stay in non- survivors	12.02 days

Post-operative mortality

- Total non-survivors = 42 (M: F= 31:11)
- overall mortality rate is 21%
- in males mortality is 18.56%
- in females mortality is 33%

Table-12

Age groups	Number of non survivors(m:f)
10-19	1(0:1)
20-29	1(0:1)
30-39	3(3:0)
40-49	9(6:3)
50-59	12(11:1)
60-69	9(7:2)
70-79	7(4:3)

Table-13: Boey's score as mortality predictor

Boey's score	Total patients	Non- survivors	%mortality
0	62	9	14.51%
1	116	21	18.10%
2	22	12	54.4%
3	0	0	0%

- Chi square test showed p value = 0.00, hence significant in finding mortality.
- At score of 1.5(arbitrarily taken by using YOUDEN METHOD, Sensitivity is 28% and specificity is 93.7%
- Predictability of mortality comes out to be 22.2%
- Hence, poor prognostic indicator of death in perforation peritonitis.

Table-14: MPI score as predictor of mortality

Score interval	Number of patients	Non- survivors	% mortality
0-5	0	0	0
6-10	5	0	0
11-15	23	1	4.166%
16-20	58	3	5.17%
21-25	54	13	24.07%
26-30	34	10	29.41%
31-35	22	12	54.54%
36-40	4	3	75%

41-45	0	0	0

- Chi square test shows p value of 0.00, hence MPI is significantly predicting mortality in secondary peritonitis patients.
- At an arbitrary score of 22.5, by using YOUDEN method, sensitivity = 85.2%, specificity = 62% and predictability = 47.7%.
- Range of MPI score = 6 -39
- Mean score of survivors = 20.48
- Mean score of non-survivors = 27.64

Table-15: *APACHE II* score as predictor of mortality

Score interval	Patients number	Non- survivors	% mortality
0-10	167	20	11.4%
11-20	33	22	66.7%

- Chi square test shows p value of 0.000, hence APACHE II significantly predicts mortality in secondary peritonitis.
- At score >9.5, YOUDEN method shows sensitivity = 64.3%, specificity = 86.7% and predictability of 51%.
- Mean score of group = 5.2
- Mean score of survivors = 4.98
- Mean score of non-survivors = 10.48

Table-16: APACHE III score as predictor of mortality

Score group	Number of patients	Non- survivors	%mortality
0 – 25	41	3	7.3%
26 – 50	116	12	10.3%
>50	43	27	62.8%

- Chi square test shows p value = 0.000, hence APACHE III is significant in predicting mortality in secondary peritonitis.
- By using YOUDEN method (at an arbitrary score of 46.5), sensitivity = 71.5%, specificity = 85.4% and predictability = 56.9%.
- Mean score of group = 40.215
- Mean score of survivors = 35.2
- Mean score of non survivors =53.1

DISCUSSION

At the end of the study, comparison was done to various previous studies done

Table-17: Comparison of sensitivity, specificity and predictability of BOEY'S SCORE, MPI, APACHE II and APACHE III

Scoring system	Sensitivity	Specificity	Predictability
Boey's	28.6%	93.7%	22.2%
MPI	85.7%	62%	47.7%
APACHEII	64.3%	86.7%	51%
APACHEIII	71.4%	85.4%	56.9%

Table-18: Age (in years) wise distribution in various studies

Year	Author	Study group	Mean age	Survivors age mean	Mortality group mean
1978- 81	Boey *et al.*[10]	213	49	48.3	65.3
1995	Aggarwal *et al.* [20]	260	34.2		
2000	Riqueleme *et al.*[11]	176	34.6	32.7	63
2001	Lee *et al.* [13]	436	51.5		
2003	Mishra *et al.* [21]	140	38.9		
2005	Nakano *et al.* [19]	412	69.1	66.5	77.2
2008	Sahu *et al.* [2]	50	38.12		
2009	Singh *et al.*	84	40.04	36.2	56.2
2012	Patil *et al.* [3]	150	42.5		
2014	GMCH -32	200	39.58	35.87	53.52

Hence, AGE in all studies (including ours) is an important predictor of mortality in secondary peritonitis

Table-19: Perforation sites comparison

Year of study	Author	Total cases	Gastroduodenal	Small bowel (ileum and jejunum)	Appendix
1993	Ohmann [17]	271	125	48	53
1995	Aggarwal [20]	260	61	103	36
2000	Riquleme [11]	174	5	5	84
2005	Ranju singh	84	48	20	8
2012	Katiyaar [5]	72	40	15	3
2012	Patil [3]	150	70	40	
2014	*Gmch 32*	*200*	*89*	*69*	*21*

SCORING SYSTEM COMPARISON

- This is the only study till date showing comparison of four scoring systems in predicting mortality in secondary peritonitis.
- Ohmann *et al*. in 1993 compared APACHE II, MPI and PIA (peritonitis index Altona) in their prospective study to compare outcome in patients of perforation peritonitis and found APACHE II to be superior[17].
- Lee *et al*. in 2001 compared APACHE II and Boey's score in a retrospective study over 436 patients and found APACHE II to be superior to BEY score in predicting both mortality and morbidity in patients of perforation peritonitis [13].

KATIYAR *et al*. in 2012 used APACHE III as a mortality predictor in secondary peritonitis over 72 patients and found APACHE III[5] as significantly predicting mortality in secondary peritonitis with increasing score:-

Table-20

Apache iii score group	Number of patients	Expired	Mortality%
0-30	35	1	2.8%
31-60	25	2	8%
>60	12	5	41.6%

This result is similar to our study in which the increase in APACHE III score is associated with increased mortality.

CONCLUSION

The study shows that even though all the compared scores significantly predict mortality in patients of secondary peritonitis, APACHE III score is most sensitive and specific. Since APACHE III has maximum predictability, it is moat accurate in predicting mortality in patients of secondary peritonitis

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