



**ROLE OF SERUM PROCALCITONIN  
C - REACTIVE PROTEIN IN EARLY DIAGNOSIS OF  
CHILDREN WITH BACTERIAL INFECTIONS**

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# INTRODUCTION

- Dilemma in paedriatic clinical practice, delayed diagnosis of bacterial infections
- Differentiate between viral and bacterial infections
- Lead to complications

# PREVALENCE OF BACTERIAL INFECTIONS

- Prevalence of bacterial infection 13%
- Cause of Death Under 5 year  
(WHO, 2006)



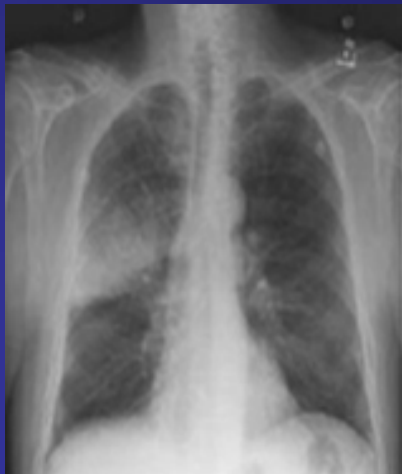
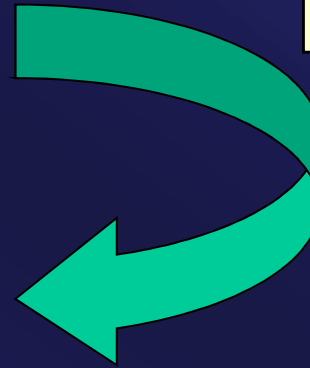
# BACTERIAL INFECTIONS



**BACTERIAL**



**VIRAL**

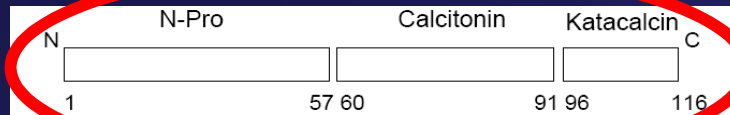


**•NEW EMERGING BIOMARKER**

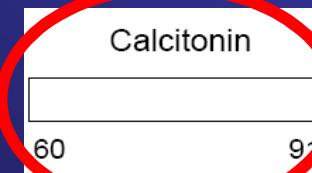
**PROCALCITONIN SINCE 1993**

# PCT = Propeptide of Calcitonin

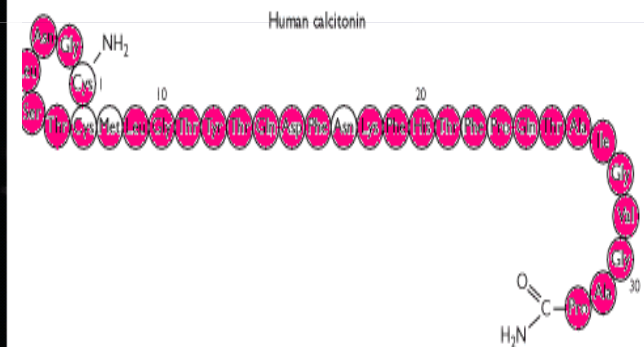
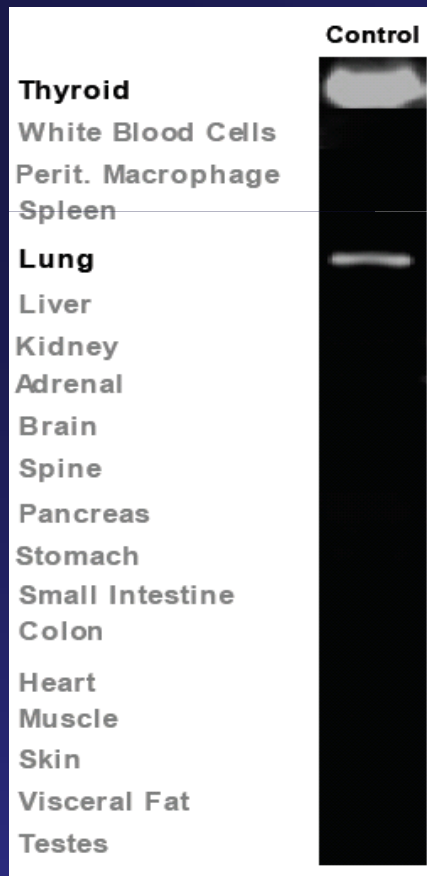
## PROCALCITONIN



## CALCITONIN

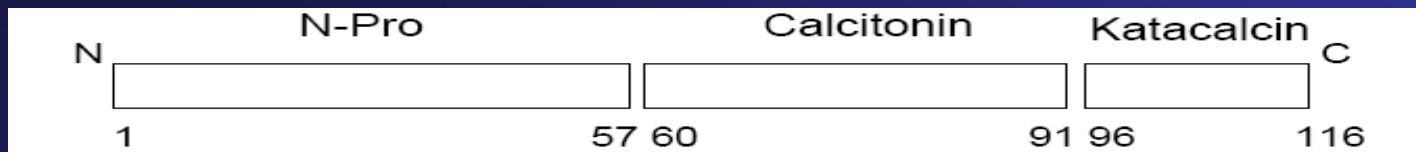


**Healthy condition:**  
Calcitonin is a peptide produced by C-cells of thyroid



**Calcitonin**

# PCT RESPONSE TO A SEVERE BACTERIAL INFECTION

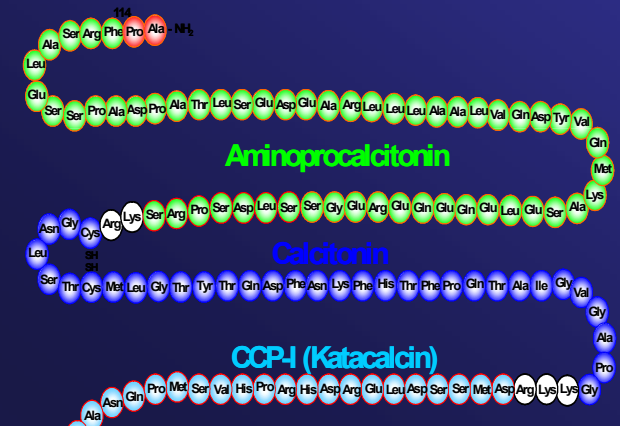
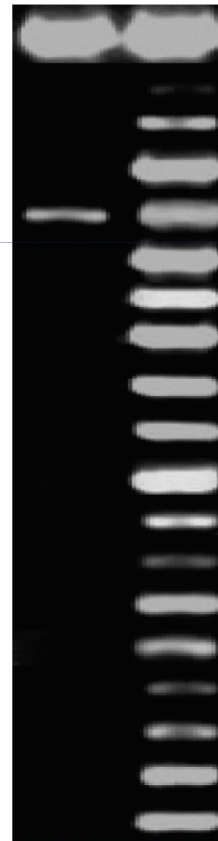


**Bacterial Infection**



- Thyroid
- White Blood Cells
- Perit. Macrophages
- Spleen
- Lung
- Liver
- Kidney
- Adrenal
- Brain
- Spine
- Pancreas
- Stomach
- Small Bowel
- Colon
- Heart
- Muscle
- Skin
- Viszerale Fat
- Testis

Control Sepsis



**PCT**

*Müller B, et al. J Clin Endocrinol Metab 2001*



# PCT: DIAGNOSIS

Family Medicine  
/Ambulatory



EMERGENCY DEPT.



ICU



**SEVERITY OF SEPSIS**

# ROLE OF PCT IN BACTERIAL PNEUMONIA

- Moulin F et al, 2001
- Ip M et al, 2007
- Simon L et al 2004
- Maniaci V et al 2008
- Don M et al 2007
- Toikka P et al 2000

**PCT MORE  
SENSITIVE AND  
SPECIFIC**

**DIFFERENTIATE  
BACTERIAL  
PNEUMONIA**

**NEED TO EARLY DIAGNOSE  
BACTERIAL INFECTIONS WITH NEW  
BIOMARKERS**



# OBJECTIVES

- EARLY DIAGNOSE THE COMMON BACTERIAL INFECTIONS IN CHILDREN BY USING SERUM PROCALCITONIN
- DETERMINE THE DIAGNOSTIC ACCURACY OF SERUM PROCALCITONIN AS COMPARED TO C - REACTIVE PROTEIN

# METHODS & MATERIALS



**CHEMICAL PATHOLOGY DEPARTMENT,  
AM COLLEGE ,RAWALPINDI**

# INCLUSION CRITERIA

- 92 CHILDREN
- AGE 1 MONTH TO 12 YEARS
- SUSPECTED PNEUMONIA
- FEVER  $\geq$  38 C
- RESPIRATORY SYMPTOMS
- CHEST X RAY INFILTRATE

# DATA COLLECTION PROCEDURES

- WRITTEN INFORMED CONSENT
- DETAILED HISTORY
- PHYSICAL EXAMINATION
- BLOOD SAMPLE COLLECTION

# EXCLUSION CRITERIA

- PULMONARY TUBERCULOSIS
- VIRAL INFECTIONS
- LIVER DISEASE
- TAKING ANY ANTIMICROBIAL AGENT WERE EXCLUDED



# PCT AND CRP ANALYSIS

- SERUM PROCALCITONIN
- SERUM CRP
- AT ADMISSION



# PCT ANALYSIS-Contd



- QUANTITATIVE VIDAS ANALYZER



- IMMULITE ANALYZER

# STATISTICAL ANALYSIS

- SPSS-16
- DESCRIPTIVE STATS
- SENSITIVITY, SPECIFICITY
- RECEIVER OPERATOR  
CHARACTERISTIC CURVE
- $P < 0.05$



# RESULTS



**PNEUMONIA:  
THE FORGOTTEN KILLER OF CHILDREN**

## PATIENTS DISTRIBUTION

- GENDER

56 (61%) MALE

36 (39%)

- 18 (39%) PLEURITIC PAIN

- 38 (83%) DULL PERCUSSION

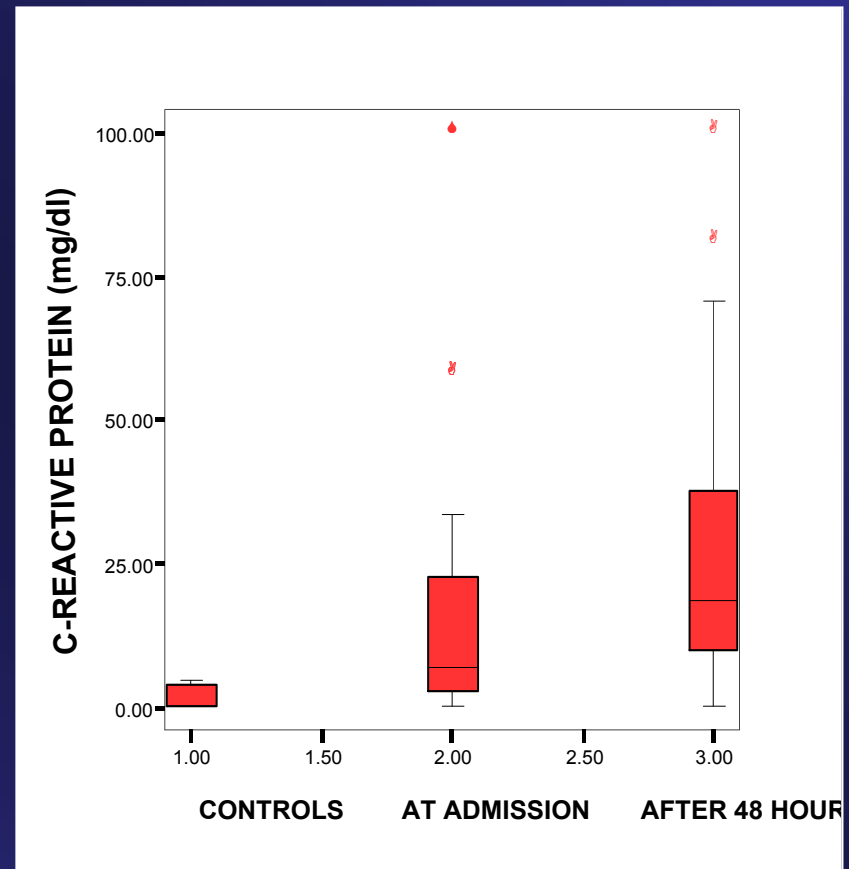
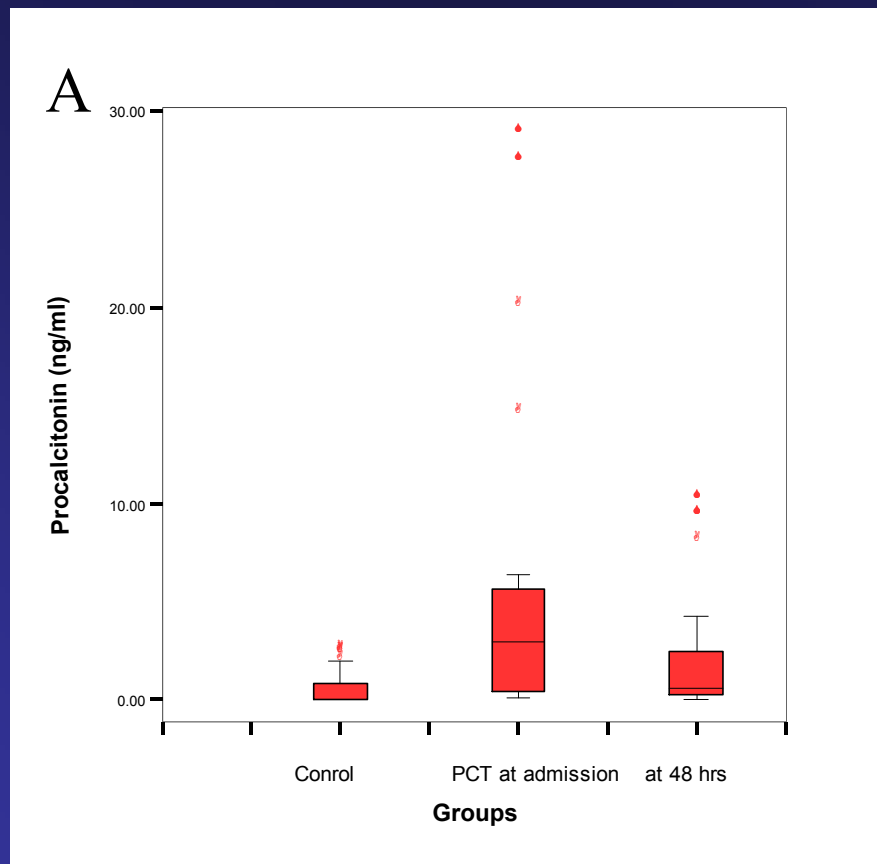
- 12 CHILDREN POSITIVE BLOOD CULTURE

- 34 CHILDREN SEROLOGICAL METHODS

## CHARACTERISTICS OF CHILDREN ADMITTED WITH PNEUMONIA (n=92)

<b>Parameters</b>	<b>Bacterial Pneumonia Median (Range)</b>	<b>Viral Pneumonia Median (Range) (n=46)</b>
<b>Age (years)</b>	<b>4 (1-12)</b>	<b>4 (1-12)</b>
<b>Sex (M/F)</b>	<b>56/36</b>	<b>56/36</b>
<b>Streptococcus pneumonia</b>	<b>28</b>	<b>-</b>
<b>Mycoplasma pneumonia</b>	<b>6</b>	<b>-</b>
<b>Procalcitonin (ng/ml)</b>	<b>2.97 (.07-37.68)</b>	<b>.005(.01-2.55)</b>
<b>CRP (mg/dl)</b>	<b>7 (.30-100.00)</b>	<b>.30 (.30-1.55)</b>

# DISTRIBUTION OF PROCALCITONIN AND CRP IN THE STUDY PARTICIPANTS

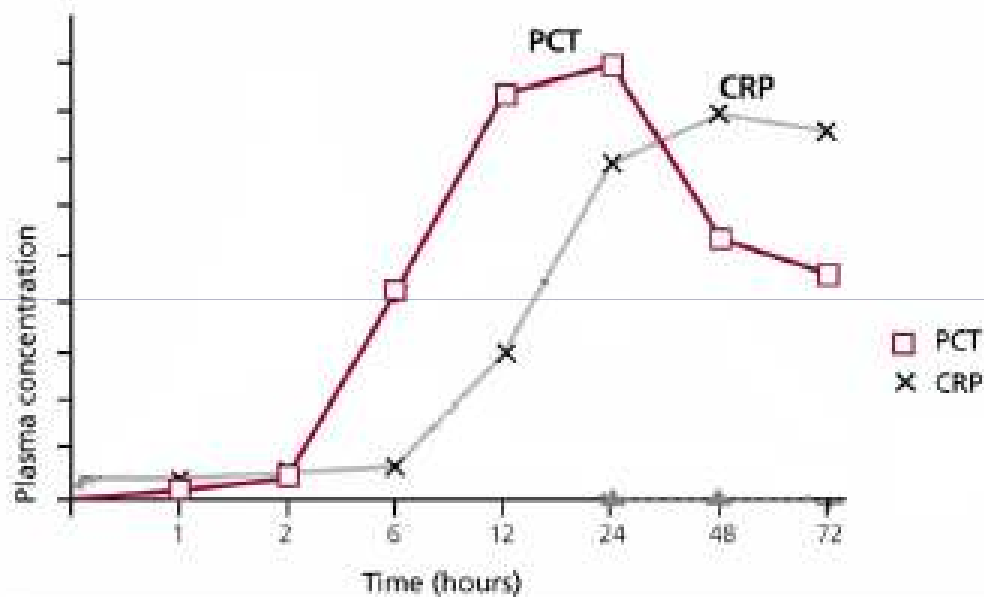


$p < 0.05$



# PATTERN OF RELEASE OF PCT AND CRP

## FAST INCREASE AFTER BACTERIAL INVASION



- Fast increase (after 3-4 hours), high dynamic range
- Plasma concentrations between  $< 0.05$  ng/ml und 1000 ng/ml
- Short half-life time ( $\sim 24$  h) independent of renal function
- Easy to measure in serum and plasma - stable *in vivo* and *in vitro*

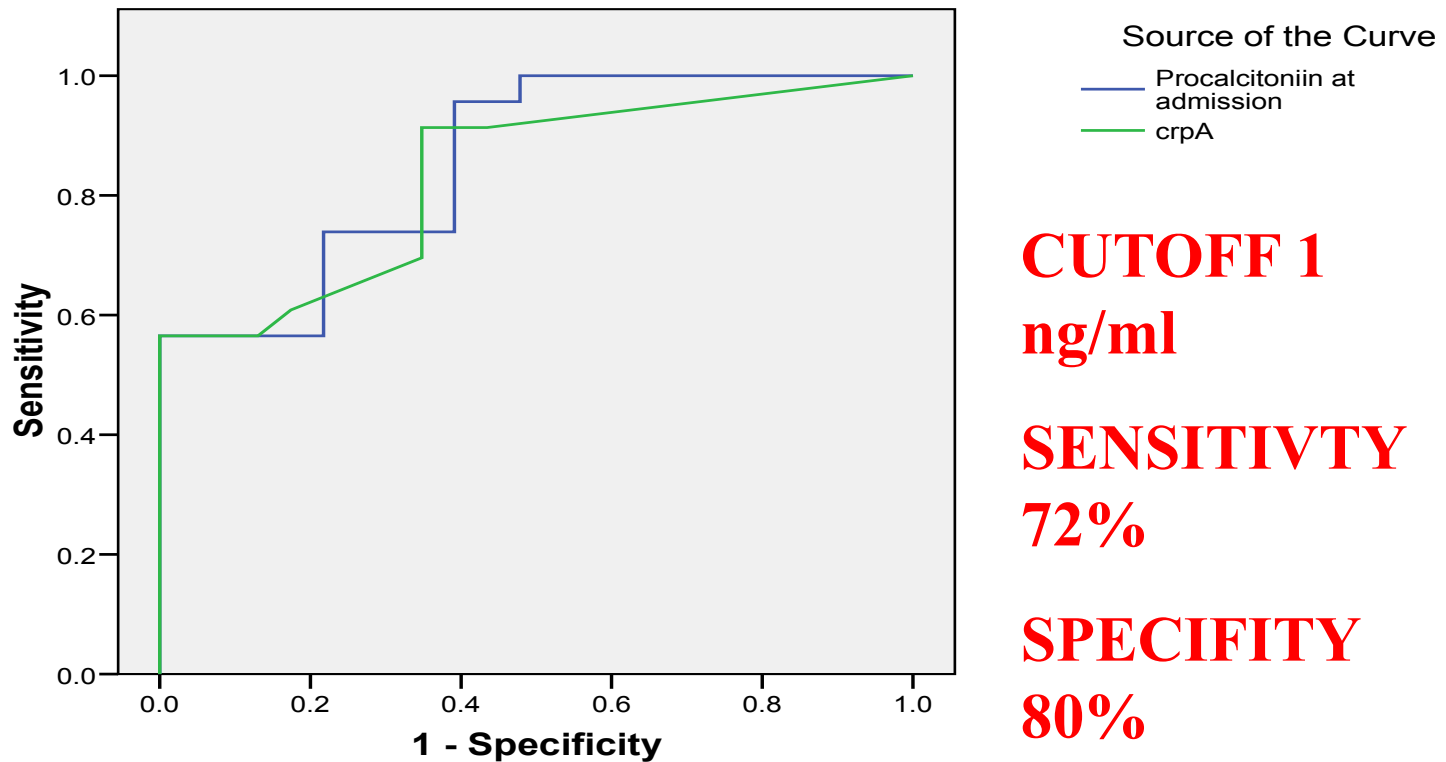
**Casedo flores et al, 2005: Jones AS et al, 2007**



# RECEIVER OPERATOR CHARACTERISTIC (ROC) CURVE FOR SERUM PCT AND CRP AT ADMISSION

**PCT AUC 0.852**

ROC Curve  
B

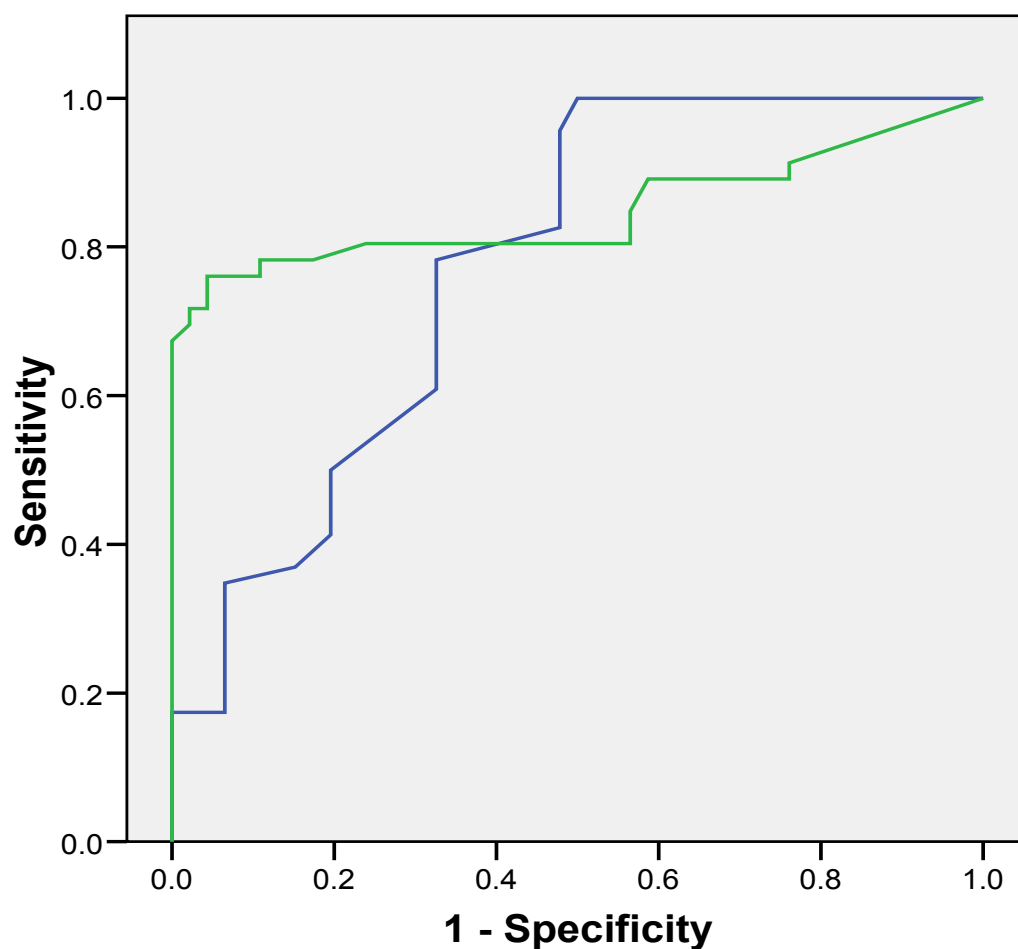


Diagonal segments are produced by ties.

# SERUM PCT AND CRP AT 48 HOURS

**CRP AUC 0.842**

**ROC Curve**



**CUTOFF 6  
mg/dl**

**SENSITIVITY  
78 %**

**SPECIFICITY  
89 %**

# DIAGNOSTIC ACCURACY OF SERUM PROCALCITONIN AND SERUM C-REACTIVE PROTEIN AT ADMISSION

Biochemical markers (Cut of value)	SE (%)	SP (%)	PPV (%)	NPV (%)	LR+	LR-	DOR
PCT $\geq$ 0.5 (ng/ ml)	74	65	68	71	2.13	0.4	5.33
PCT $\geq$ 1 (ng/ ml)	72	80	79	74	3.68	0.35	10.51
PCT $\geq$ 2.0 (ng/ ml)	56	83	76	66	3.25	0.53	6.13
CRP $\geq$ 4 (mg/ dl)	65	83	79	70	3.75	0.42	8.93
CRP $\geq$ 6 (mg/ dl)	56	96	93	69	13	0.45	28.9
CRP $\geq$ 10 (ng/ ml)	39	98	95	62	18	0.62	29.0

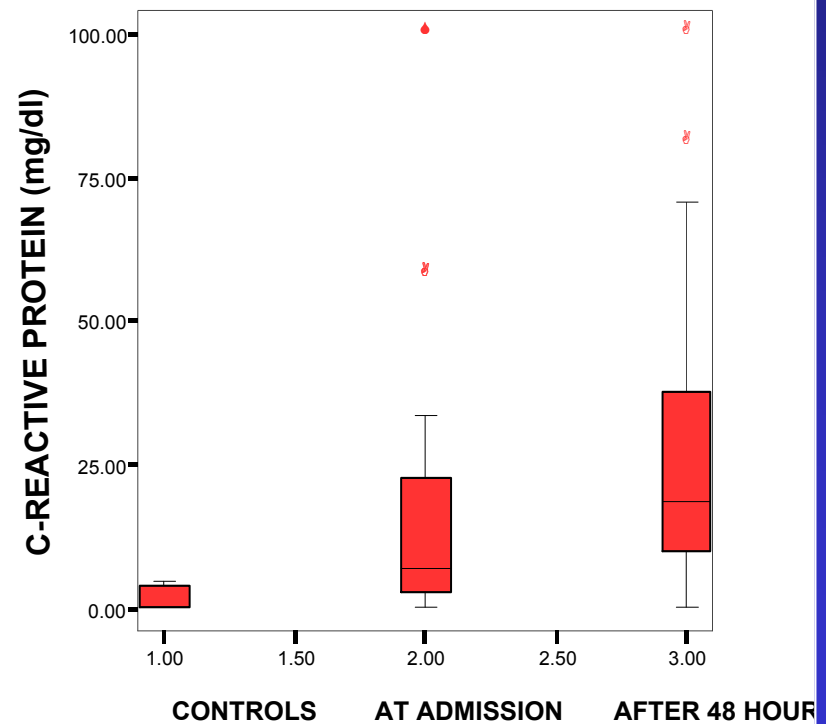
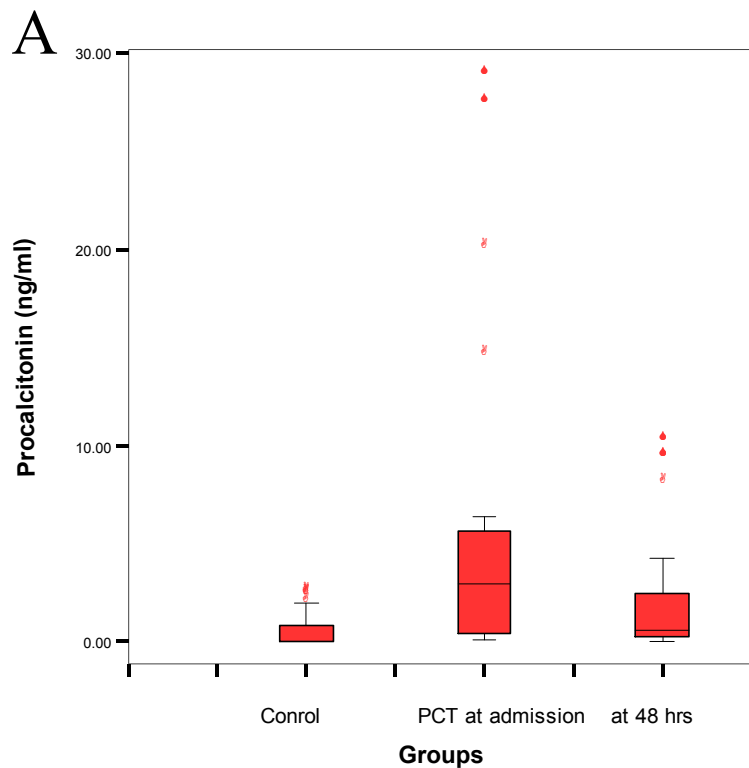
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PCT $\geq$ 0.5 (ng/ ml)	50	80	72	62	2.56	0.62	4.13
PCT $\geq$ 1 (ng/ ml)	43	81	69	59	2.22	0.70	3.17
PCT $\geq$ 2 (ng/ ml)	37	85	71	57	2.43	0.74	3.28
CRP $\geq$ 4 (mg/ dl)	80	78	79	80	3.7	0.25	14.8
CRP $\geq$ 6 (mg/ dl)	78	89	88	80	7.2	0.24	30

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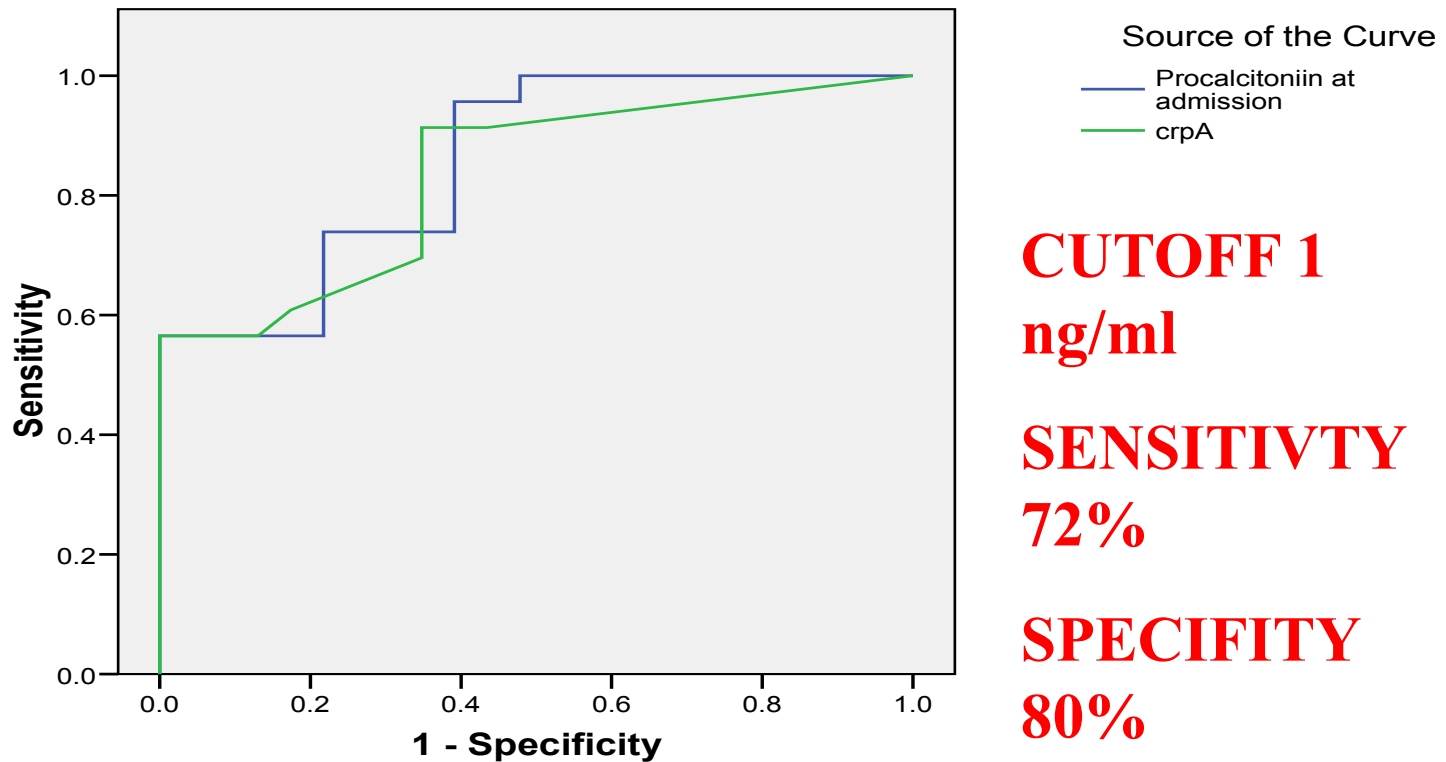
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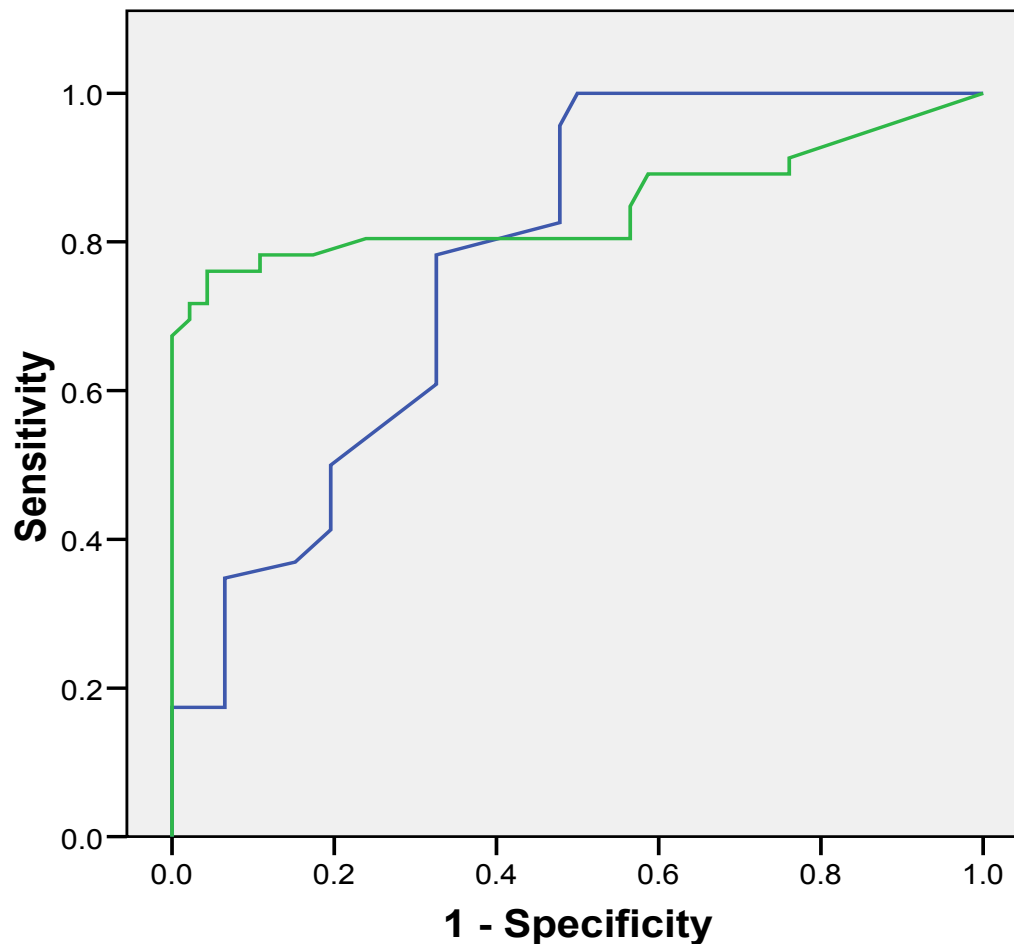
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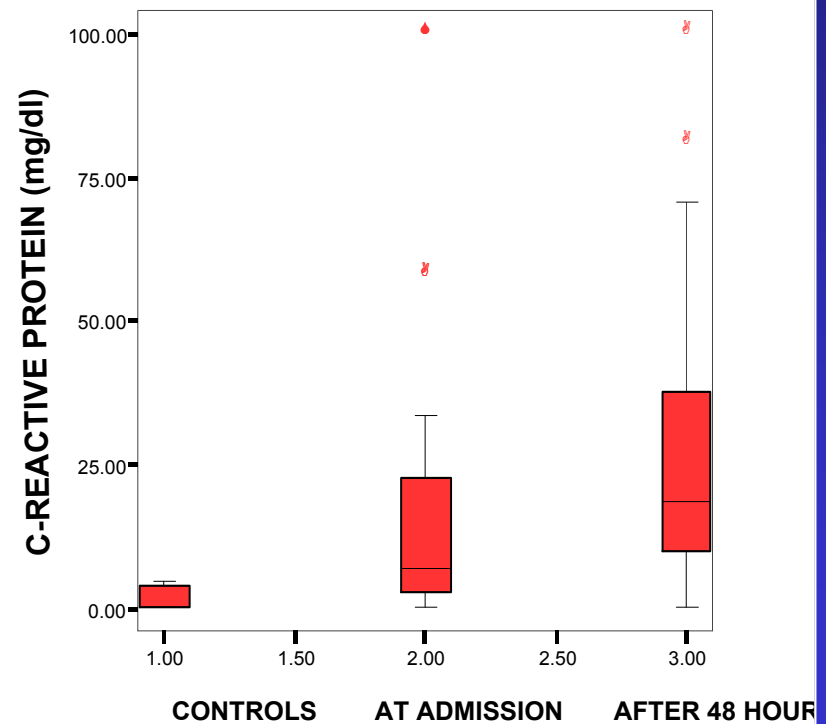
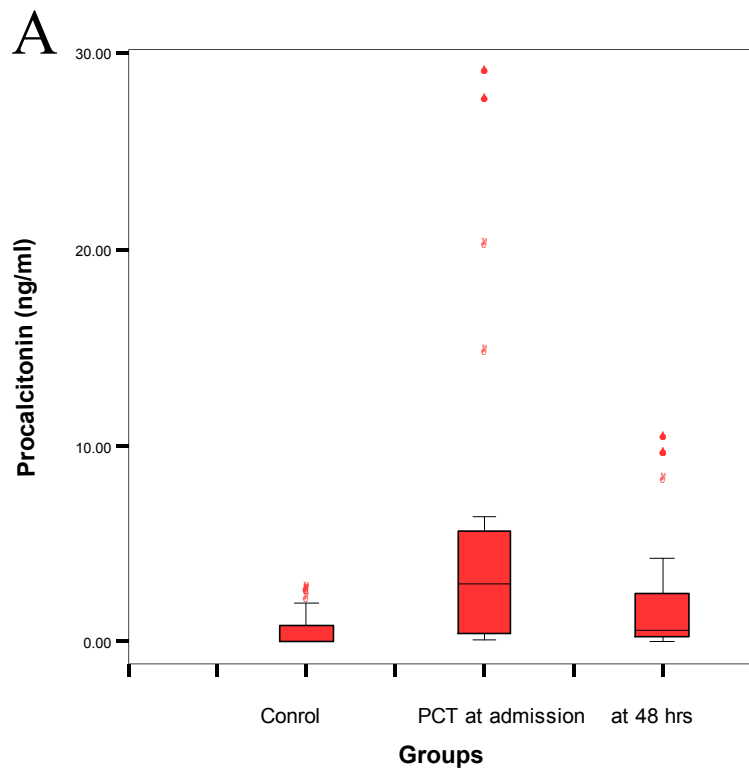
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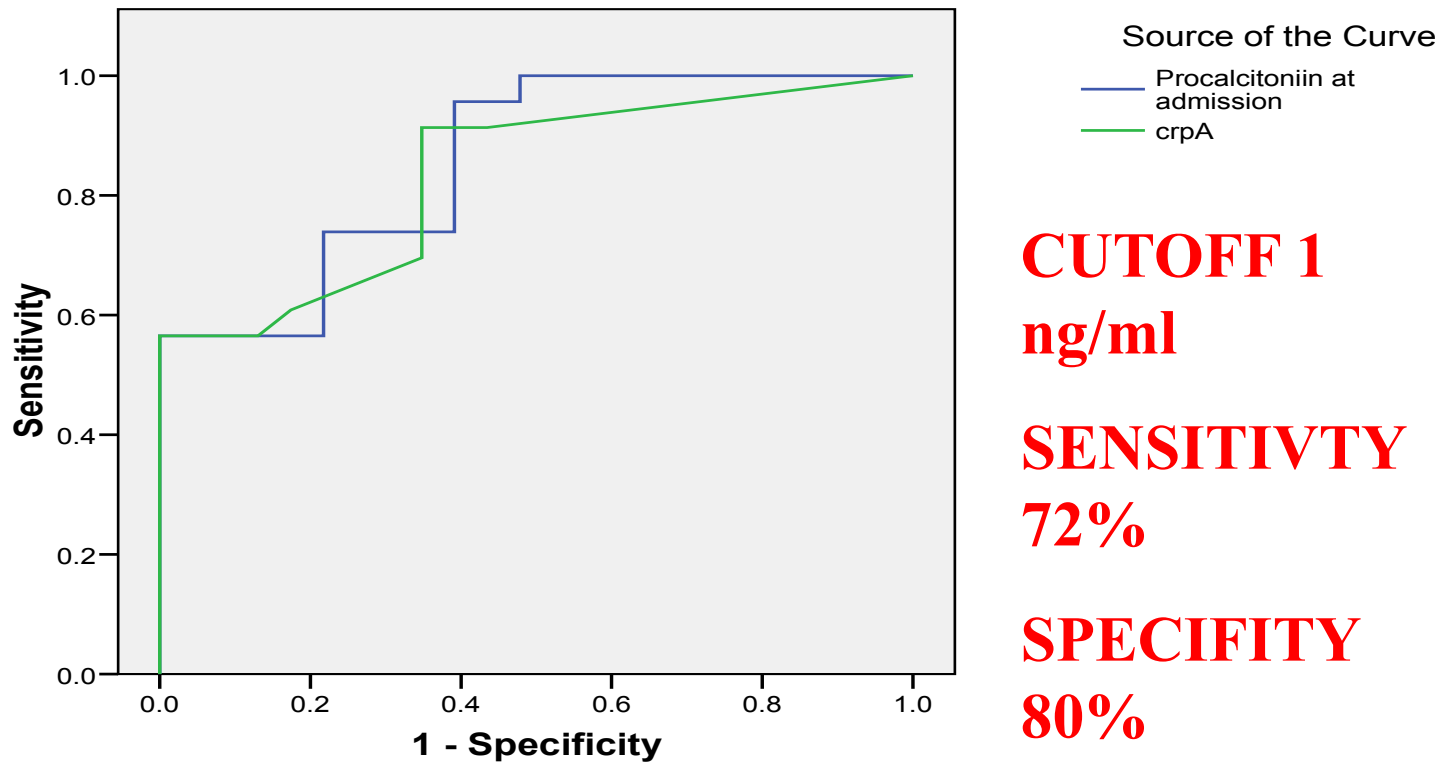
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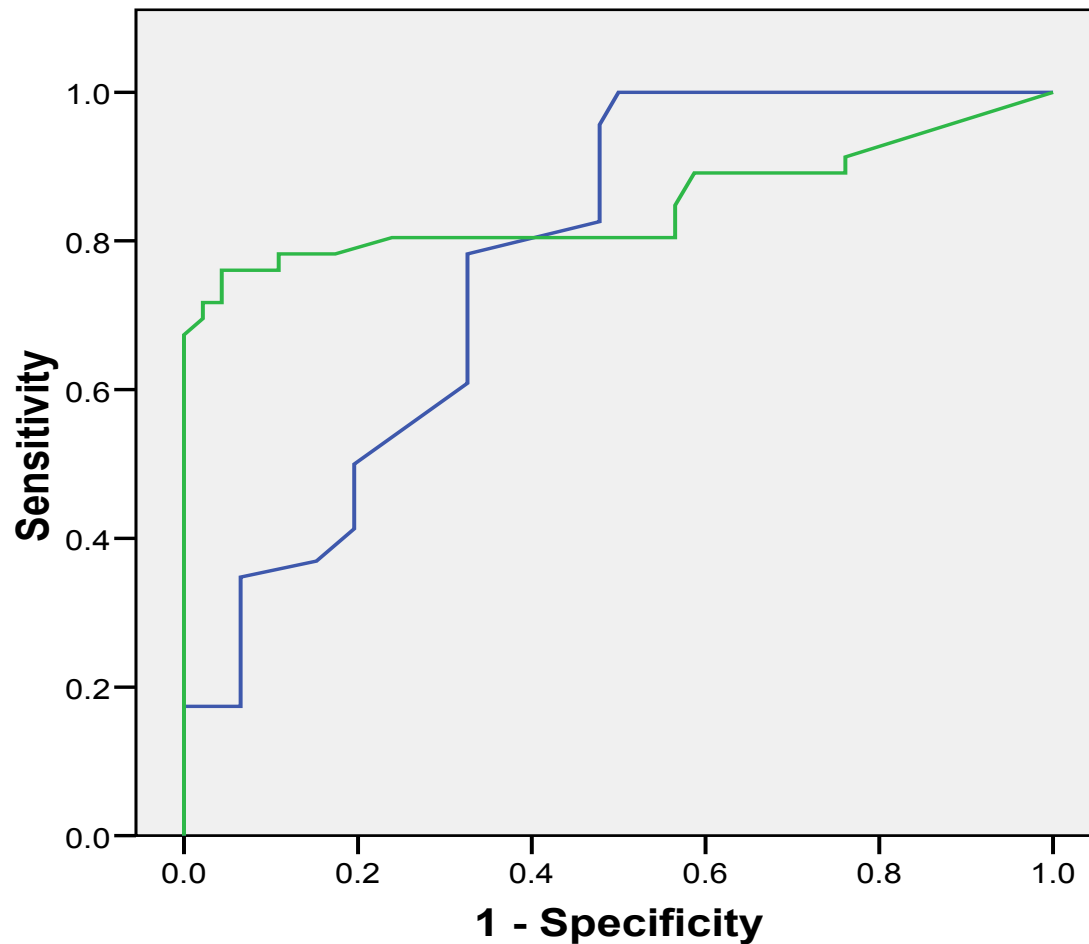


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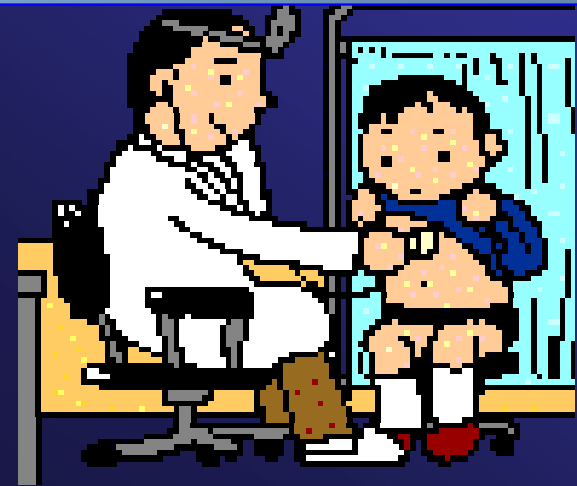
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# CONCLUSION

- **RELIABLE MARKER FOR EARLY PREDICTION**
- **THE DIAGNOSTIC ACCURACY STUDY HIGH SENSITIVITY, SPECIFICITY AND LIKELIHOOD RATIO WITH CUTOFF VALUE OF 1 ng/ml FOR PCT**



THANK YOU FOR YOUR PATIENT  
LISTENING