

EVALUATION OF SERUM C-REACTIVE PROTEIN LEVELS BEFORE AND AFTER CARDIOPULMONARY BYPASS FOR CARDIAC SURGERY

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ABSTRACT: With the new arrivals in open heart surgery and cardiopulmonary bypass, the present study was undertaken to monitor the extent of acute inflammatory response to cardiopulmonary bypass by using serum CRP as an indicator and correlating this with the early morbidity and mortality in patients undergoing cardiopulmonary bypass for cardiac surgery. 25 patients, aged 10-40 years of NYHA Class I, II, III scheduled for open heart surgeries with the use of cardiopulmonary bypass were included in the study in our study. The serum CRP levels were measured at 6 hours and 24 hours after weaning from cardiopulmonary bypass. The results were analysed using the unpaired t-test to find out if the increase in serum CRP levels and patient morbidity were statistically significant. There were no significant differences regarding anesthetic premedication, induction and maintenance drugs and intraoperative hemodynamics between patients with duration of cardiopulmonary bypass ≤ 90 min. & those with the duration of >90 minutes. However there was a change in the level of CRP between these two groups. Increase in the levels of serum CRP at 6 hours and 24 hours after weaning from cardiopulmonary bypass was noted in patients who developed morbidity and mortality post procedure. All the above mentioned patients with complications had undergone cardiopulmonary bypass of duration >90 min. In our study, Aprotinin was used in 4 patients and these patients had reduced mean CRP as compared to the controls. Elevated serum concentration of CRP is an unequivocal evidence of an active tissue damage process. CRP levels invariably rise after major surgery but fall to normal within 7-10 days. Absence of this fall is indicative of possible septic or inflammatory postoperative complications. Further, by serial measurements important information can be obtained on the resolution or continuation of the inflammatory process. Thus, we conclude that serum CRP levels can be used to monitor the extent of inflammatory response induced by cardiopulmonary bypass. The duration of cardiopulmonary bypass directly influences the inflammation and damage caused which is suggested by patient morbidity and mortality in the postoperative period.

KEY WORDS: C reactive Protein, Cardio pulmonary bypass, inflammatory mediators, cardiac surgery.

METHODS: The present study titled "Evaluation of Serum C-Reactive Protein Levels Before and After Cardiopulmonary Bypass for cardiac surgery" was carried out in Department of Anaesthesiology with collaborative support of the Department of Microbiology, Gandhi Medical College & Associated Hospital, Bhopal. Procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975 that was revised in 2000

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Subjects: The subjects for the present study were selected after a thorough pre anesthetic checkup & informed consent was taken. 25 patients of age group 10-40 yrs of either sex of NYHA Class I, II, III were selected for the study. The patients were posted for open heart surgery under cardiopulmonary bypass e.g. single valve replacement (MVR), double valve replacement (MVR & AVR), atrial septal defect (ASD) closure etc. done under general anesthesia.

The subjects on anticoagulants, those with coronary artery disease (myocardial infarction, angina), overweight patients were excluded from the study. All the patients had normal hepatic, cerebral, renal and coagulation profile.

A. ANESTHETIC TECHNIQUE :

Pre-medication: All the patients were given the following drugs as premedicants

I/V Glycopyrrolate 0.2mg

I/V Midazolam 1 mg

I/V Fentanyl 1-2 µg/kg or I/V Sufentanil 2µg/kg

5-10 minutes before surgery.

Induction: All patients were induced i/v Thiopentone 4-6 mg/kg & intubation facilitated with i/v Vecuronium 0.08 to 0.12 mg/kg. Intubation was done with polyvinyl chloride cuffed endotracheal tube of appropriate size.

Maintenance: All patients were maintained on 100 % O₂ & Isoflurane 0.2 to 1.2% intermittently, i/v Vecuronium 0.02 mg/kg in intermittent boluses was used to maintain muscle relaxation during the procedure. Nitroglycerine and Dopamine and Dobutamine were infused in titrated doses to maintain vasodilation and inotropic support to the cardiovascular system of the patient.

Aprotinin was given in 4 patients, selected on the basis of those undergoing reoperation or those with endocarditis. 1ml test dose of aprotinin was administered i.v. through the central line 10 minutes before the loading dose. The loading dose [100 ml which contains 140 mg or 1 million kallikrein inactivator units (KIU)] was given slowly over 20-30 minutes, after induction of anesthesia but prior to sternotomy. The pump oxygenator prime was arranged to contain 100ml of the drug, in a concentration of 10,000 units/ml in a normal saline solution.

Patients were given i/v Heparin 3mg/kg 5 minutes before aortic cannulation. ACT before giving heparin and 5 minutes after giving heparin was noted. Subsequently, ACT was monitored every half hourly during cardiopulmonary bypass.

After aortic cannulation, cardiopulmonary bypass was initiated and time was noted. During cardiopulmonary bypass, the mean arterial pressure was allowed to maintain between 50 and 90 mm Hg. Deviations beyond this range were controlled with phenylephrine or nitroglycerine. At the termination of cardiopulmonary bypass, time was noted again. Heparin was reversed with i/v protamine 1.2 mg for every 1mg of Heparin given. ACT after giving protamine was noted.

The patients were shifted to cardiac intensive care unit on elective mechanical ventilation. Muscle relaxation and sedation was maintained by i/v vecuronium 0.02 mg/kg and i/v midazolam 1mg given intermittently for 6-18 hours postoperatively.

Monitoring:

Continuous Electrocardiogram

Pulse Oximetry

End tidal carbon dioxide

Invasive blood pressure

Central venous pressure

Pulmonary artery pressure (in patients with left ventricular ejection fraction < 40%) & intermittent pulmonary artery wedge pressure

Urine output

Temperature

Activated clotting time

Arterial blood gas analysis

B. CARDIOPULMONARY BYPASS PROCEDURE

1. Circuit assembly: The cardiopulmonary bypass machine used in our study was Sarns make 9000 model of year 2000 of USA. Non pulsatile cardiopulmonary bypass was performed with following parts:

1. Four roller pumps
2. Membrane oxygenator (SPICTRA)
3. Cardioplegia delivery system (SPICTRA)
4. Tubings
5. Cannulae
 - a. Aortic
 - b. Venous
6. Cardioplegia cannula
7. Coronary perfusion cannula
8. Hypothermia machine/ heat exchanger (Hemotherm)
9. Filter in the arterial line.

2. Priming solution/diluent

The composition of priming solution used in all patients in our study was same and was as follows:

Lactated Ringer's solution	-	500ml
5% Dextrose	-	500ml
6% hydroxy ethyl starch	-	500ml
20% Mannitol	-	5ml/kg
Sodium bicarbonate	-	1ml/kg
Heparin	-	5000 I.U.
Antibiotic	-	1.2 gms in adult patients 500 mg in paediatric patients
Lasix	-	20 mg

3. Temperature: Hypothermic cardiopulmonary bypass was used in all patients. The nasopharyngeal temperature was monitored and was kept at 31°C to 34°C (mild hypothermia) during cardiopulmonary bypass.

4. Cardioplegic solution: The solution in our study consisted of

- | | | |
|---------------|---|---------------------|
| 1. Plegiocard | - | Each 20 ml contains |
| Potassium | - | 16 mmol |
| Magnesium | - | 16 mmol |
| Procaine | - | 1 mmol |
2. Ringer's lactate 1 litre
 3. Sodium bicarbonate 7.5% 50ml
 4. Whole blood

Cardioplegic solution at a temperature of 10°C was delivered into the aortic root to maintain cardioplegia during aortic cross clamping.

C. ESTIMATION OF C-REACTIVE PROTEIN

1. Three blood samples were taken at the following times :

- Pre operative serum CRP within 24 hrs of the scheduled surgery.
- Post operative serum CRP 6 hrs after the termination of cardiopulmonary bypass
- Post operative serum CRP 24 hrs after the termination of cardiopulmonary bypass.

In each of the above three samples, 3ml of blood was collected in a glass vial without preservative and taken immediately to the Department of Microbiology for conducting the test. If test could not be undertaken at that time, the sample was stored at 2-8°C in refrigerator.

2. CRP test kit :

The CRP test was done in the Department Of Microbiology by Rhelax CRP kit of Tulio Diagnostics (P) Ltd, Goa. The Rhelax CRP slide test for the detection of CRP is based on the principle of agglutination which is done on glass slide. The materials provided with the kit are:

- Reagent : CRP latex reagent (A uniform suspension of polystyrene latex particles coated with anti CRP antibodies. The reagent is standardized to detect CRP concentration greater than 0.6 mg/dl), positive control, negative control.
- Accessories : Glass slide with 6 reaction circles, sample dispensing pipette, mixing sticks, rubber teat.

3. Additional material required :

- Stop watch
- Test tubes
- High intensity direct light source
- Isotonic saline

4. Test procedure :

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All the three blood samples of the patient taken at different times were tested for C-reactive protein by the following procedure. Reagent and sample were brought to room temperature before testing for qualitative and semi-quantitative as follows :

Qualitative analysis:

- a. One drop on the specimen, i.e. serum was put on the glass slide, using a disposable pipette provided with the kit.
- b. One drop of CRP latex reagent was dropped on this serum taken on the slide, taking care not to touch.
- c. Using a mixing stick, the serum & the CRP latex reagent were uniformly mixed over the entire circle.
- d. A stopwatch was started immediately. The slide was gently shaken back and forth, observing for agglutination macroscopically at 2 minutes.

Semi quantitative analysis:

- a. The serum which showed agglutination by the qualitative method was diluted using isotonic saline in serial dilutions of 1:2, 1:4, 1:8, 1:16 & so on.
- b. Each dilution of the serum was dropped on to separate reaction circles with the help of a pipette.
- c. One drop of CRP latex was added to each of the above diluted test samples and stopwatch started immediately.
- d. The slide was gently shaken back & forth, to mix the solutions uniformly. Agglutination was observed macroscopically at 2 minutes in each of the diluted samples.

Interpretation of test results:

1. Qualitative analysis:
Agglutination was taken as positive test result & indicated the presence of detectable levels of CRP in the test specimen.
2. Semi quantitative analysis :
Agglutination in the highest serum dilution was taken as the amount of CRP in mg/dl present in the test specimen. The level of CRP was calculated by the following formula:
$$\text{CRP (mg/dl)} = S \times D$$

Where S=Sensitivity of the reagent i.e. 0.6mg/dl
D=Highest dilution of serum showing agglutination

Statistical analysis: The results were analysed using the unpaired t-test to find out if the increase in serum CRP levels and patient morbidity were statistically significant. In all calculations, standard deviations were calculated. The t-value was calculated using the unpaired t-test and p-value was calculated. A p-value <0.001 was considered significant.

RESULTS: Present the results in a logical sequence in the text, tables, and illustrations. Do not repeat in the text all the data in the tables or illustrations. Instead, emphasize on or summarise only important observations. With the new arrivals in open heart surgery and cardiopulmonary bypass,

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the present study was undertaken to monitor the extent of acute inflammatory response to cardiopulmonary bypass by using serum CRP as an indicator and correlating this with the early morbidity and mortality in patients undergoing cardiopulmonary bypass for cardiac surgery. This study was conducted in the Department of Anaesthesiology with collaborative support of the Department of Microbiology, Gandhi Medical College & Associated Hospital, Bhopal.

25 patients, aged 10-40 years of NYHA Class I, II, III scheduled for open heart surgeries with the use of cardiopulmonary bypass were included in the study. All the patients scheduled for the various open-heart surgeries underwent thorough anaesthetic check up. In our study, the majority of patients belong to the age group 10-20 years. The majority of surgical procedures were mitral valve replacement, followed by double valve replacement, aortic valve replacement, ASD closure and left atrial myxoma excision. The duration of cardiopulmonary bypass in our study was more than 90 minutes in majority of patients. There were no significant differences between patients with duration of cardiopulmonary bypass ≤ 90 min. & those with the duration of >90 minutes regarding anaesthetic premedication, induction and maintenance drugs. There was no significant difference in both the groups regarding intraoperative haemodynamic.

In patients with duration of cardiopulmonary bypass ≤ 90 min., the mean serum CRP level 6 hrs after weaning from cardiopulmonary bypass was 1.94 ± 1.27 mg/dl and 24 hours after weaning from cardiopulmonary bypass was 6.76 ± 2.8 mg/dl. In patients with duration of cardiopulmonary bypass >90 min., the mean CRP levels 6 hours after weaning was 7.2 ± 4.42 mg/dl and 24 hours after weaning was 20.23 ± 11 mg/dl.

Morbidity and mortality in the postoperative period was assessed. Four patients had cardiac complications in which mean serum CRP levels were found to be 8.4 mg/dl 6 hours after weaning and 19.2 mg/dl 24 hours after weaning. One patient had surgical haemorrhage with mean serum CRP levels of 19.2 mg/dl 6 hours after weaning and 38.4 mg/dl 24 hours after weaning. Diffuse bleeding was found in one patient with serum CRP level of 2.4 mg/dl 6 hours after weaning and 38.4 mg/dl 24 hours after weaning. One patient had pulmonary dysfunction with serum CRP level of 9.6 mg/dl 6 hours after weaning and 38.4 mg/dl 24 hours after weaning. One patient had acute renal failure with serum CRP level of 4.8 mg/dl 6 hours after weaning and 9.6 mg/dl 24 hours after weaning from cardiopulmonary bypass. The number of deaths reported in our study was 2 who had a mean serum CRP of 14.4 mg/dl 6 hours after weaning and 28.8 mg/dl 24 hours after weaning from cardiopulmonary bypass. All these patients had undergone cardiopulmonary bypass of duration >90 min.

In our study, Aprotinin was used in 4 patients. These patients had mean CRP of 3.85 mg/dl at 6 hours & 12 mg/dl at 24 hours after termination of cardiopulmonary bypass. This is different from other patients who were not given Aprotinin as their CRP levels were 5.08 mg/dl at 6 hours after weaning and 14.74 mg/dl 24 hours weaning from cardiopulmonary bypass.

CONCLUSION: Elevated serum concentration of CRP is an unequivocal evidence of an active tissue damage process and CRP measurement, thus, provides a simple screening test. Its use in postoperative surveillance is of great importance. CRP levels invariably rise after major surgery but fall to normal within 7-10 days. Absence of this fall is indicative of possible septic or inflammatory postoperative complications. Further, by serial measurements important information can be obtained on the resolution or continuation of the inflammatory process. Thus, we conclude that

serum CRP levels can be used to monitor the extent of inflammatory response induced by cardiopulmonary bypass. The duration of cardiopulmonary bypass directly influences the inflammation and damage caused which is suggested by patient morbidity and mortality in the postoperative period.

With the above observations, we can conclude that:

- a. Serum CRP levels can be used to monitor the extent of inflammatory response induced by cardiopulmonary bypass.
- b. The duration of cardiopulmonary bypass directly influences the inflammation and damage caused which is suggested by patients morbidity and mortality in the postoperative period. This can be monitored by serial serum CRP levels.
- c. Aprotinin may be a potential drug to reduce the inflammation but this needs larger controlled trials to be done.

DISCUSSION: Cardiopulmonary bypass and cardiac surgery unleash a broad and intense acute inflammatory response that varies in degree between patients. This response together with micro-embolisation is responsible for most of the morbidity of cardiopulmonary bypass and cardiac surgery.

During cardiopulmonary bypass, haemodynamic alterations and the inflammatory response are the main causes of homeostatic disruption. Although mortality is low as demonstrated by various studies, disruption of homeostasis may contribute to increased morbidity in high risk patients. The magnitude of the body's defence reaction during and after cardiopulmonary bypass is influenced by many exogenous factors that include the surface area of the perfusion circuit, the duration of blood contact with extravascular surface, general health and preoperative organ function of the patients, blood loss and replacement, organ ischemia and reperfusion injury, sepsis, different degrees of hypothermia ,periods of circulatory arrest, genetic profiles and pharmacologic agents used such as corticosteroids, aprotinin etc.

Continued interest in this response has stimulated the search for more cohesive knowledge and for ways of minimising unfavourable outcomes of cardiac surgery using cardiopulmonary bypass with valid bedside markers in order to assist the perfusionist in improving the adequacy of cardiopulmonary bypass.

Serum CRP levels have long been used as a general marker of acute inflammation and infection. It is a very sensitive and reliable indicator. Rises in CRP are only one part of a number of intricate changes in serum proteins and enzymes but it happens to be one that is earliest to measure because it increases dramatically. In a study conducted by Deodhar (1989) CRP increased more than 20 times after significant trauma, surgery or burns. This elevation persisted for a much longer time, when tissue necrosis was more extensive suggesting its value to monitor patient outcome.

Our study was conducted to evaluate serum CRP levels before and after cardiopulmonary bypass for cardiac surgery and using it as an indicator of the extent of acute inflammatory response, morbidity and mortality. The study was conducted in 25 patients of either sex, in the age group of 10-40 years, NYHA Class I, II, III scheduled for various open heart surgeries undergoing cardiopulmonary bypass. The maximum number of patients in our study were in the age group of 10-20 years as shown in Table no.1. The distribution of patients is almost equal for males and

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females as shown in Table no.2. The patients underwent thorough pre-anaesthetic check up and investigations. Informed consent was taken.

The patients were posted for various types of open heart surgeries which mainly consisted of valve replacement either single or double. Most of the surgeries were those of mitral valve replacement as shown in Table no 3. All the patients had their baseline serum CRP levels tested before induction. Mean CRP level was < 0.6 mg/dl. All the patients were pre medicated and induced with the standard anesthetic technique according to a fixed protocol. Non invasive and invasive monitoring was used.

The duration of cardiopulmonary bypass was noted. Most of the patients had a bypass duration between 60 and 120 minutes. The blood samples for serum CRP levels were collected at 6 hours and 24 hours after termination of cardiopulmonary bypass. The serum CRP levels were found to be positive in all the patients i.e., >0.6 mg/dl. The mean serum CRP levels at 6 hrs. After weaning from cardiopulmonary bypass were found to be 4.89 mg/dl which is more than 23 times the preoperative value. This indicates that the inflammatory response to cardiopulmonary bypass causes a dramatic increase in serum CRP levels.

The C3 complement protein which is the first protein of the complement cascade is activated by C reactive protein when its levels rise in response to inflammation caused by cardiopulmonary bypass. The C3 is, thereby, converted to C3a. Therefore, the increase in CRP levels parallels the increase in C3a levels in this inflammatory response. Kirklin and colleagues identified C3a, a complement breakdown product, in blood shortly after commencing cardiopulmonary bypass for cardiac surgery and found that its continuing production was proportional to body temperature and perfusion flow rate. The result was that more than 50% of patients had serum C3a levels above 1000ng/dl and 25% of patients had levels greater than 1600 ng/ml at the end of operation with cardiopulmonary bypass. Higher C3a levels were found at 3 hours after cardiopulmonary bypass in patients with morbidity (cardiac, pulmonary, renal and coagulation dysfunction) (p value < 0.05) and in patients with a longer duration of cardiopulmonary bypass.

In our study, when the duration of cardiopulmonary bypass was less than 90 minutes, the mean serum CRP levels were found to be 1.94 ± 1.27 mg/dl at 6 hrs. and 6.76 ± 2.8 mg/dl at 24 hrs after weaning from cardiopulmonary bypass as shown in Table No. 6. These values were compared with the values in patients who had cardiopulmonary bypass duration of more than 90 minutes. The mean serum CRP levels in the latter patients were 7.2 ± 4.42 mg/dl at 6 hrs and 20.23 ± 11 mg/dl at 24 hrs after termination of cardiopulmonary bypass. This is statically significant (p<0.001).

The incidence of morbidity and mortality within 7 days of surgery can be clearly demonstrated in Table no. 7. The morbidity was assessed in terms of cardiac complications like arrhythmias (AF, PVCs), low cardiac output, poor cardiac contractility, haemorrhage (surgical site, diffuse bleeding), pulmonary dysfunction (acute respiratory distress syndrome) and renal dysfunction (acute renal failure). All the patients in whom morbidity (8 patients) and mortality (2 patients) was noted had a duration of cardiopulmonary bypass more than 90 minutes. This is statistically significant.

The observed data demonstrate that serum CRP level monitoring can be done to monitor the extent of damage done by cardiopulmonary bypass. The safe duration cannot be fully defined as this relationship is affected by other risk factors as well like hypothermia, absence of hemodilution,

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strength of the patients humoral and cellular responses to cardiopulmonary bypass and younger age.

In our study, Aprotinin was administered i.v. in 4 patients. The drug was given in a loading dose of 100 ml just after induction but before sternotomy and the pump oxygenator prime was arranged to contain 50 ml of the drug. These patients had a mean CRP level of 3.85 mg/dl at 6 hrs and 12 mg/dl at 24hrs after termination of cardiopulmonary bypass. These values are lesser when compared with the values of patients not given Aprotinin.

Moreover there was no morbidity and mortality noted in the patients given aprotinin. This indicates that the inflammation induced by cardiopulmonary bypass is considerably lesser in these patients which, in turn, indicate lesser morbidity, lesser hospital stay, and lesser mortality. Since the cases in which aprotinin was used were less, definite conclusion cannot be made.

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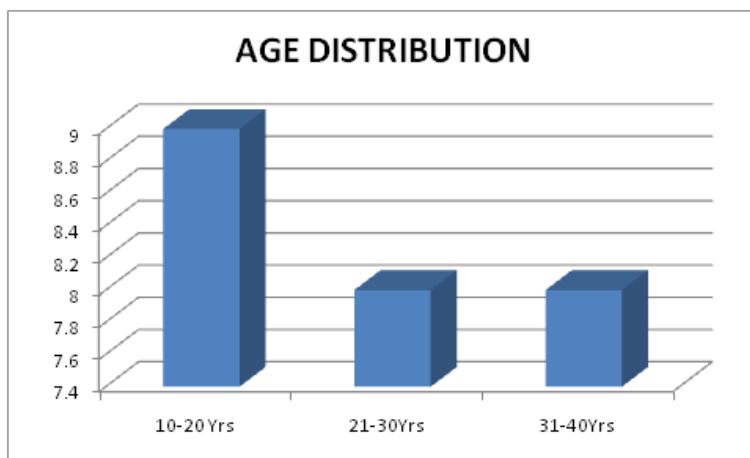
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S.NO.	Age Group	No. of Patients	Percentage
1	10-20 Yrs	9	36
2	21-30Yrs	8	32
3	31-40Yrs	8	32
		25	100
TABLE NO.1: AGE DISTRIBUTION			

The table shows the age distribution of patients in our study. They are almost equally distributed among all age groups



S.NO.	Age Group	No. of Patients	Percentage
1	Males	11	44
2	Females	14	56
		25	100
TABLE NO. 2: SEX DESTRICTION			

The table shows the sex distribution.

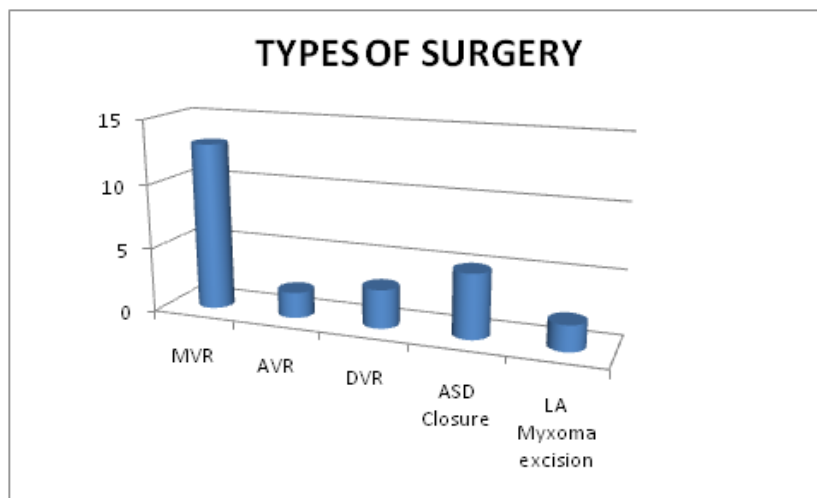
ORIGINAL ARTICLE



S.No	Types of surgery	No. of Patients	Percentage
1	MVR	13	52
2	AVR	2	8
3	DVR	3	12
4	ASD Closure	5	20
5	LA Myxoma excision	2	8

TABLE NO. 3: TYPES OF SURGERY

MVR = Mitral Valve Replacement AVR = Aortic Valve Replacement
 DVR = Double Valve Replacement ASD = Atrial Septal Defect LA = Left Atrium.
 The majority of patients underwent MVR.

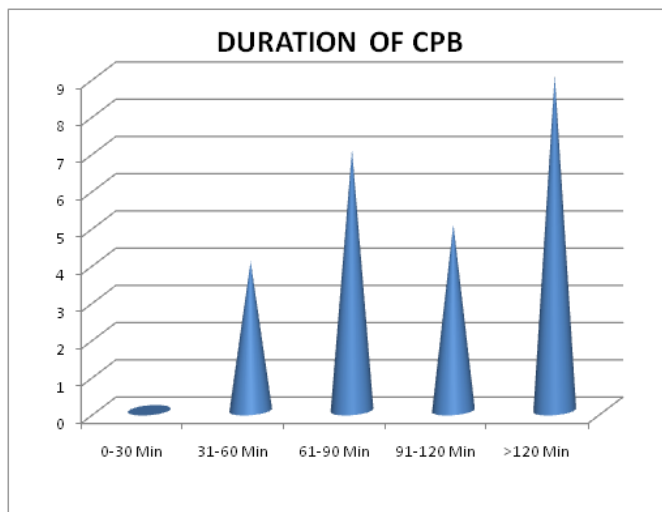


S.NO	Duration of CPB	No of Patients	Percentage
1	0-30 Min	0	0
2	31-60 Min	4	16
3	61-90 Min	7	28
4	91-120 Min	5	20
5	>120 Min	9	36

TABLE NO. 4: DUTATION OF CARDIOPULMONARY BYPASS

The table shows the distribution of duration of cardiopulmonary bypass in all patients. The majority of patients had a duration of cardiopulmonary bypass in the range of 61-120 minutes.

ORIGINAL ARTICLE



A. CRP level distribution:

CRP Level (mg/dl)	Pre bypass	Post bypass	
		6hrs.	24hrs.
<0.6	24	00	00
>0.6	01	25	25

TABLE NO. 5: SERUM C-REACTIVE PROTEIN LEVELS

The table shows the serum CRP levels distribution in the pre-bypass period and at 6 hrs and 24 hrs after weaning from cardiopulmonary bypass. Levels <0.6 are not significant. All the patients had significantly.

Increased levels after cardiopulmonary bypass.

B. Mean CRP levels

	Pre bypass	Post bypass	
		6 hrs	24 hrs
Mean CRP Level(mg/dL)	<0.6	4.89	14.3

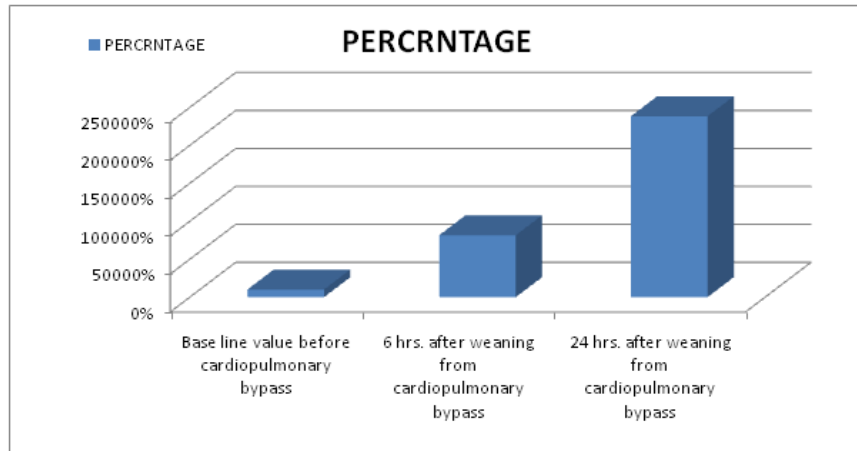
The table shows the mean CRP levels in the pre-bypass period and at 6 hrs and 24 hrs after termination of cardiopulmonary bypass.

C. Percentage increase in mean CRP levels.

Base line value before cardiopulmonary bypass	100%
6 hrs. after weaning from cardiopulmonary bypass	81.5%[8.15 times]
24 hrs. after weaning from cardiopulmonary bypass	2383%[23.8 times]

The table shows the percentage increase in mean CRP levels which is significant.

ORIGINAL ARTICLE



S.No		≤90 Min	>90 Min
1.	Mean CRP at 6 hrs	1.94 ± 1.27 mg/dl	7.2 ± 4.42mg/dl
2.	Mean CRP at 24 hrs	6.76 ± 2.8mg/dl	20.23 ± 11mg/dl

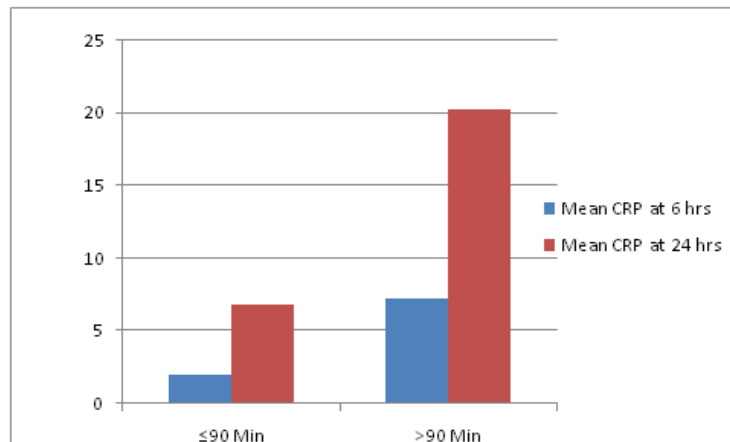
TABLE NO. 6: ELATION OF SERUM CRP LEVELS WITH DURATION OF CARDIOPULMONARY BYPASS

The table shows the relation of mean serum CRP levels and duration of cardiopulmonary bypass. This is statically significant ($p < 0.001$).

	≤90 Min	>90Min
Morbidity and Mortality	0	10

TABLE NO. 7: RELATION OF DURATION OF CARDIOPULMONARY BYPASS AND MORBIDITY AND MORTALITY

The table shows the relation of duration of cardiopulmonary bypass and morbidity and mortality within 7 days of surgery. There is significantly increased morbidity and mortality when the duration of cardiopulmonary bypass is increased.



ORIGINAL ARTICLE

S.NO	Complication	No. of Patients	Mean duration of cardiopulmonary bypass (Min.)	Mean CRP	
				At 6 hrs	At 24 hrs
1	Cardiac complication	4	153.75	8.4	19.2
2	Surgical haemorrhage	1	180	19.2	38.4
3	Diffuse bleeding	1	110	2.4	38.4
4	Pulmonary Dysfunction	1	122	9.6	38.4
5	Acute renal failure	1	110	4.8	9.6
6	Mortality	2	150	14.4	28.8

TABLE NO. 8: RELATION OF MORBIDITY & MORTALITY WITH IN 7 DAYS OF SURGERY AND MEAN SERUM CRP LEVELS

The table shows the relation between the number and types of complications (morbidity and mortality) within 7 days of surgery and the mean serum CRP levels.

	Patients not given aprotinin in cardiopulmonary bypass	Patients given aprotinin in cardiopulmonary bypass
No of Patients	21(84%)	4(16%)
Mean CRP at 6 hrs	5.08 mg/dl	3.85mg/dl
Mean CRP at 24 hrs	14.74 mg/dl	12mg/dl

TABLE NO. 9: RELATION OF APROTININ AND MEAN CRP LEVELS

The table shows the relation of aprotinin and its effect on mean serum CRP level. This is not significant because the sample size is small.

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