

P21

LIST OF PROCEDURES DONE
PROJECT REPORT

TITLE OF THE PROJECT:

"Hematological and Biochemical Investigations
in Post operative sheep with Prosthetic Mitral
valve Replacement with Chitosa Tilting disc
valve prosthesis"

NAME..... Dr. Bhoyar A.B.

PROGRAMME..... M.Ch. (CVTS)

MONTH & YEAR
OF SUBMISSION..... October 1986

Forwarded

Pravaranai
HOD CVTS 27.10.86

Forwarded.
Answer
8/10/86

Name	Dr. Bhoyar
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- Note:— (i) In the case compilation of procedures done, the contents and the subsequent pages should be made into different sections (a) Procedures done (b) Procedures assisted (c) Procedures participated (d) Procedures attended/participated etc in Other Centres. Each section should be preceded by a leaf carrying the name of the section that is succeeding.
- (ii) The Contents page will carry into, as per model given under

PROCEDURES DONE

Closed Mitral valvotomy.....124 (say)
 Patent ductus arteriosus-ligation.....10
 Atrial septal defects.....20

PROCEDURES ASSISTED

Closed Mitral valvotomy.....100 (say)

- (iii) In the subsequent pages details of each procedure done/assisted should be given in the format given below:—

Heading: **Closed mitral valvotomy**

Date	Name of the patient	Age	Sex	Patient No.
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- (iv) In the case of Project Report in the page immediately following the Certificate page the under-mentioned details should be given:—

- (a) Title
- (b) Duration
- (c) Aim and scope
- (d) 50 word summary of work done

CERTIFICATE

I, Dr. Bhojar A. B. hereby declare that I have actually performed all the procedures listed/carried out the project under report.

Signature..... Bhojar

Place: Trivandrum

Name in DR. BHOJAR A. B.

Date: 3/10/86

capital letters

Name	<u>Dr. Bhojar</u>
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CONTENTS

A) Project Report.

" Hematological and Biochemical Investigations in Postoperative sheep with Prosthetic mitral valve Replacement with Chitra Tilting disc valve prosthesis "

B) Procedures Participated.

- i) Mitral Valve Replacement in Sheep with Chitra Tilting disc valve prosthesis
- ii) Autopsy of Post-operative sheep with Chitra Tilting disc valve prosthesis
- iii) In vitro evaluation of Chitra cardiometry reservoir cum filter.

Aim :-

The analysis of hematological and biochemical investigations was undertaken to know the effect of Chitra Tilting Disc Valve prosthesis on formed elements of the blood, mainly red blood cells.

Procedure :-

Before submitting the sheep for operation, hematological investigations are carried out to rule out anaemia and the focus of infection, if any. LDH, plasma hemoglobin and reticulocyte counts are performed to know the base line values. These investigations are repeated on the first post-operative day, then once in a week for 4 weeks. After that investigations are repeated every fortnightly.

Animals available for investigations are given in Table no - 1.

Table No - 1.

<u>Period</u>		<u>No. of Animals</u>
Preoperative	-	13
1 st POD	-	10
7 th POD	-	10
14 th POD	-	10
21 st POD	-	9
28 th POD	-	7
6 th Post-6week	-	3

Observations :-

A copy of observations is submitted to Registrar; Dr. Misa Mohanthy and Dr. Arthur.

Table no. 2 gives the comprehensive analysis of preoperative and post-operative investigations.

Period.	Hb. (gm%)	P.C.V. (%)	T.L.C. (---/mm ³)	Platelets (---/mm ³)	serum Na _i (meq/lit-)	serum K _i (meq/lit-)	BUN (mg%)	LDH (IU/lit-)	Plasma Hb (mg%)
Preop.	9.9 - 14.6 mm - 12.8	30 - 44 mm - 37.38	6000 - 26,590 mm - 9,131	153,000 - 618,000 mm - 403,384	130 - 155 mm 142.0	4.2 - 6.3 mm 5.24	15 - 30 mm 22.62	261.41 - 774.50 mm 363.0	0.8 - 2.5 mm 6.76
1 st POD	5.8 - 11.0 mm - 8.76	16 - 32 mm - 25.8	4700 - 13,000 mm - 8,639	145,000 - 505,000 mm 276,000	145 - 160 mm 151.56	3.2 - 5.2 mm 4.04	20 - 32 mm 24.7	629 - 1065 mm 806.0	0.8 - 10.1 mm 5.25
7 th POD	7.5 - 12.2 mm - 9.32	23 - 36 mm - 27.55	8200 - 21,000 mm - 12,465	165,000 - 807,000 mm 485,000	100 - 150 mm 138.2	3.8 - 7.1 mm 5.39	18 - 45 mm 31.4	619 - 1258 mm 811.0	0.8 - 19.2 mm 5.84
14 th POD	6.7 - 12.2 mm - 9.6	18 - 36 mm - 29.0	8850 - 50,550 mm - 16,765	236,000 - 1,007,000 mm 480,000	115 - 155 mm 142.0	4.5 - 6.1 mm 5.1	24 - 42 mm 31.7	416 - 871 mm 635.0	0.8 - 42.56 mm 8.81
21 st POD	8.2 - 13.0 mm - 10.64	24 - 11 33.3	8100 - 22,700 mm - 12,861	199,000 - 646,000 mm 481,000	135 - 155 mm 145.0	4.6 - 5.9 mm 5.2	24 - 44 mm 30.53	377.6 - 668.64 mm 501.00	0.53 - 31.92 mm 8.07
28 th POD	8.8 - 12.6 mm 10.55	26 - 38 mm - 32.0	6150 - 21,800 mm - 12,814	421,000 - 790,000 mm 553,000	140 - 160 mm 148.2	4.7 - 6.7 mm 5.6	24 - 35 mm 32.0	377.6 - 654.5 mm 469.0	4.52 - 18.8 mm 7.85.
42 nd POD	10 - 11.4 mm - 10.63	30 - 34 32.3 - mm	10350 - 13,630 mm - 14,966	407,000 - 699,000 mm 585,000	125 - 148 mm 133.3	5.1 - 5.6 mm 5.3	28 - 30 mm 29.0	367 - 609 mm 516.0	-

Conclusions :-

Observations are analysed upto 28th post-operative days.

1) There is marked drop in hemoglobin post-operatively. It gradually increases in post-operative period. It doesn't attain preoperative value by 28th post-operative day (see Graph no 1)

2) PCV goes in parallel to hemoglobin. (see Graph no 2)

3) Total and differential leukocyte counts are the good indicators of post-operative infection. (see Graph no 3)

4) There is marked drop in platelet count as measured on 1st post-operative day. It attains preoperative value by 7th post-operative day (Graph no 4)

5) Serum sodium is higher on 1st post-operative day. (physiological response).

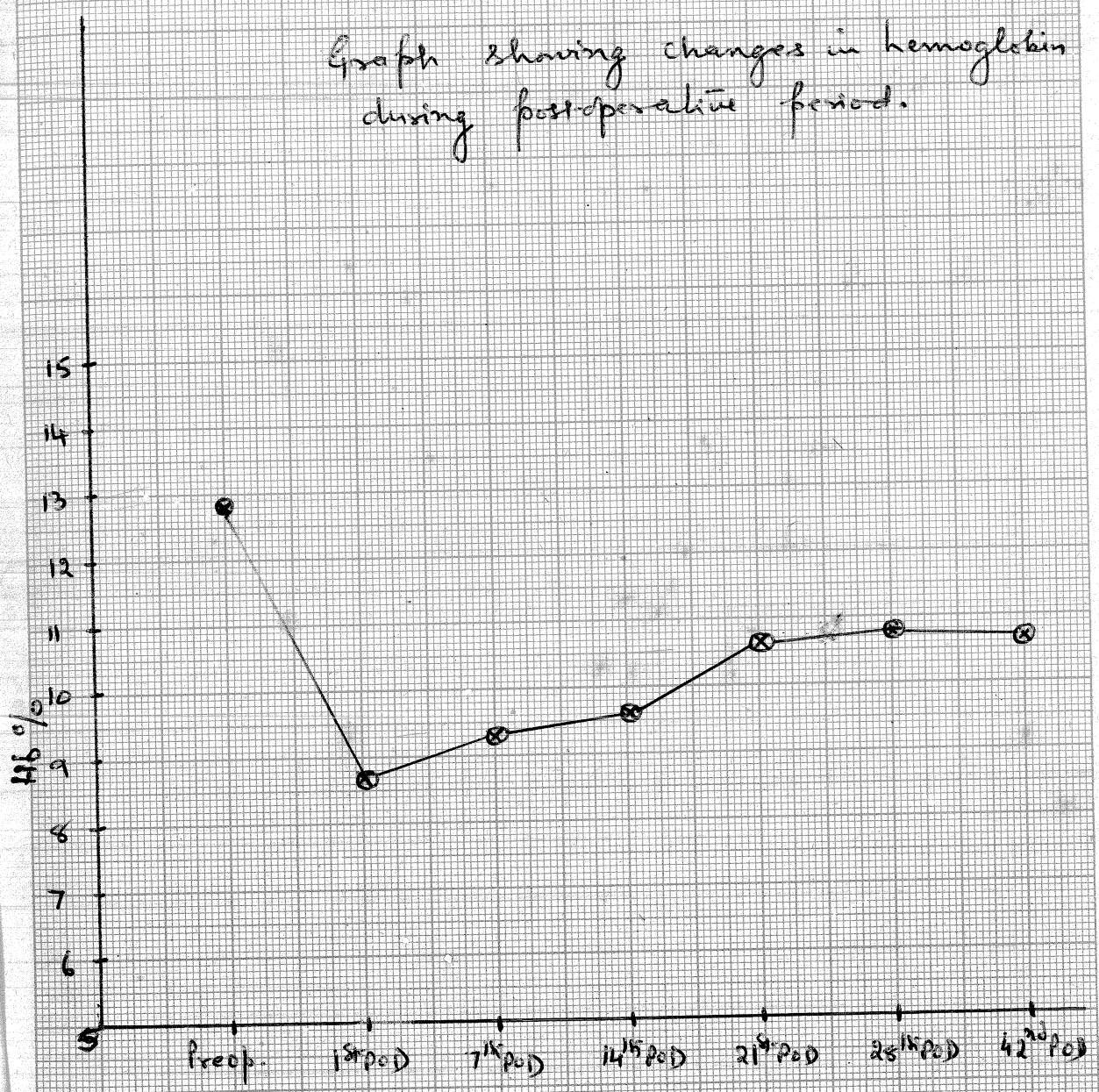
6) There is no appreciable change in serum potassium.

7) Blood urea nitrogen remains mildly elevated during post-operative period.

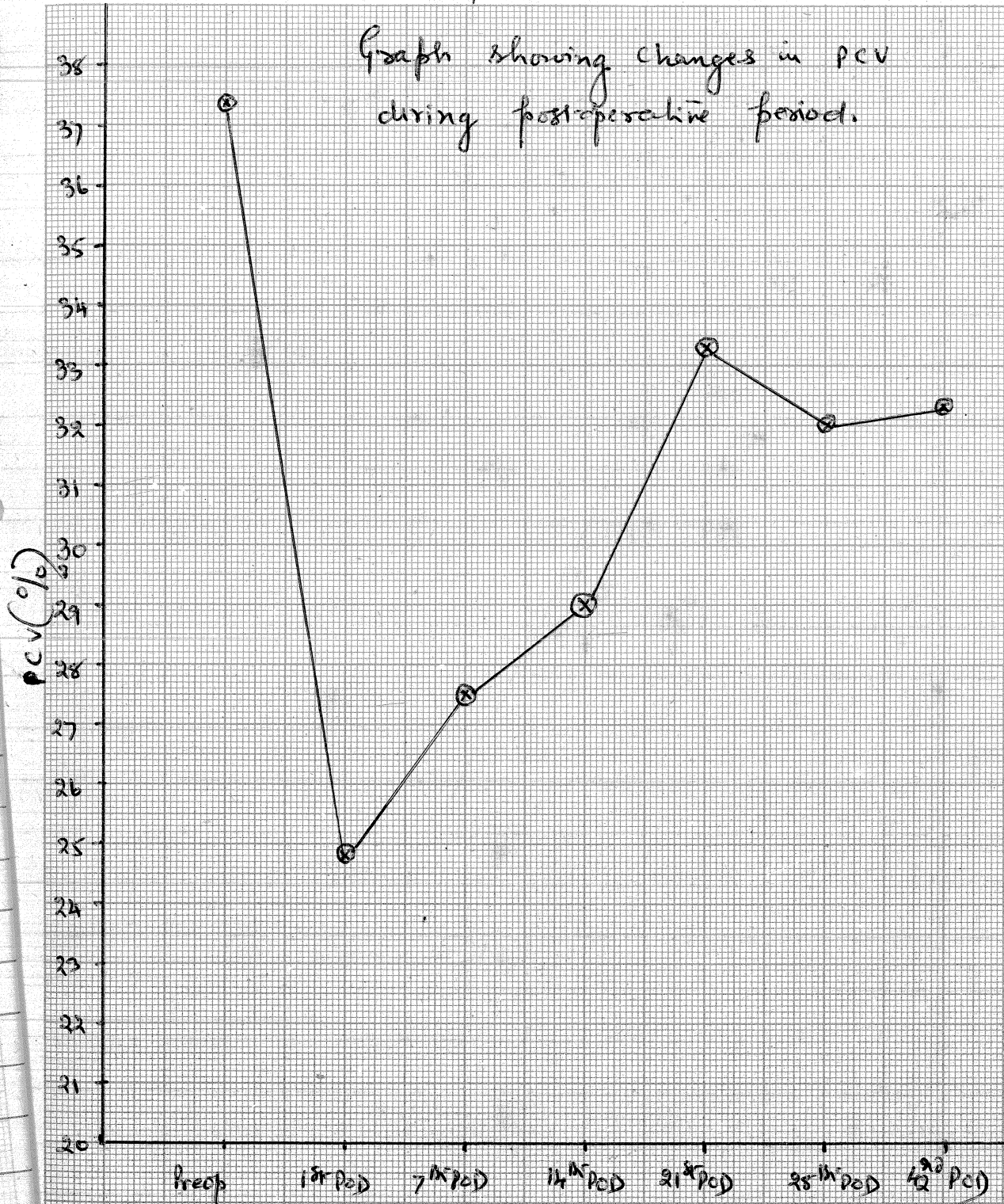
- 8) There is marked increase in LDH on 1st post-operative day. It gradually comes down. Hemoglobin and serum LDH has got reciprocal relationship. (see graph no 5)
- 9) Plasma hemoglobin doesn't go parallel with serum LDH. There is no correlation between plasma hemoglobin and hemoglobin/hematocrit.
- 10) Reticulocytes in sheep are very few in number (they are in fractions) and thus interpretation is difficult.
- 11) Post operative sheep with para-valvular leak do have slightly more but mild hemolysis as compared to sheep without para-valvular leak. (see graph no 6)

Graph NO - 1

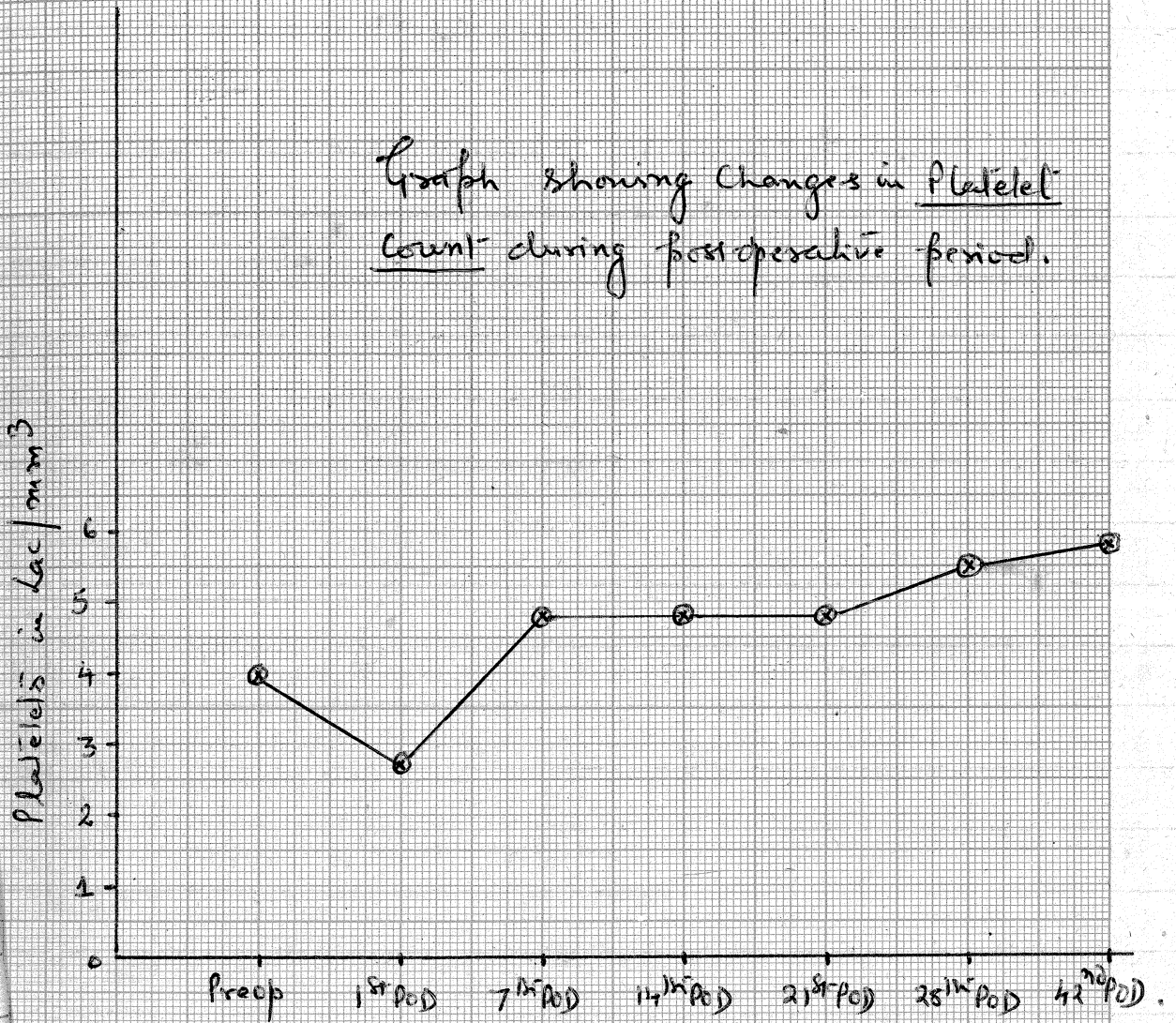
Graph showing changes in hemoglobin during postoperative period.



Graph showing changes in PCV during postoperative period.

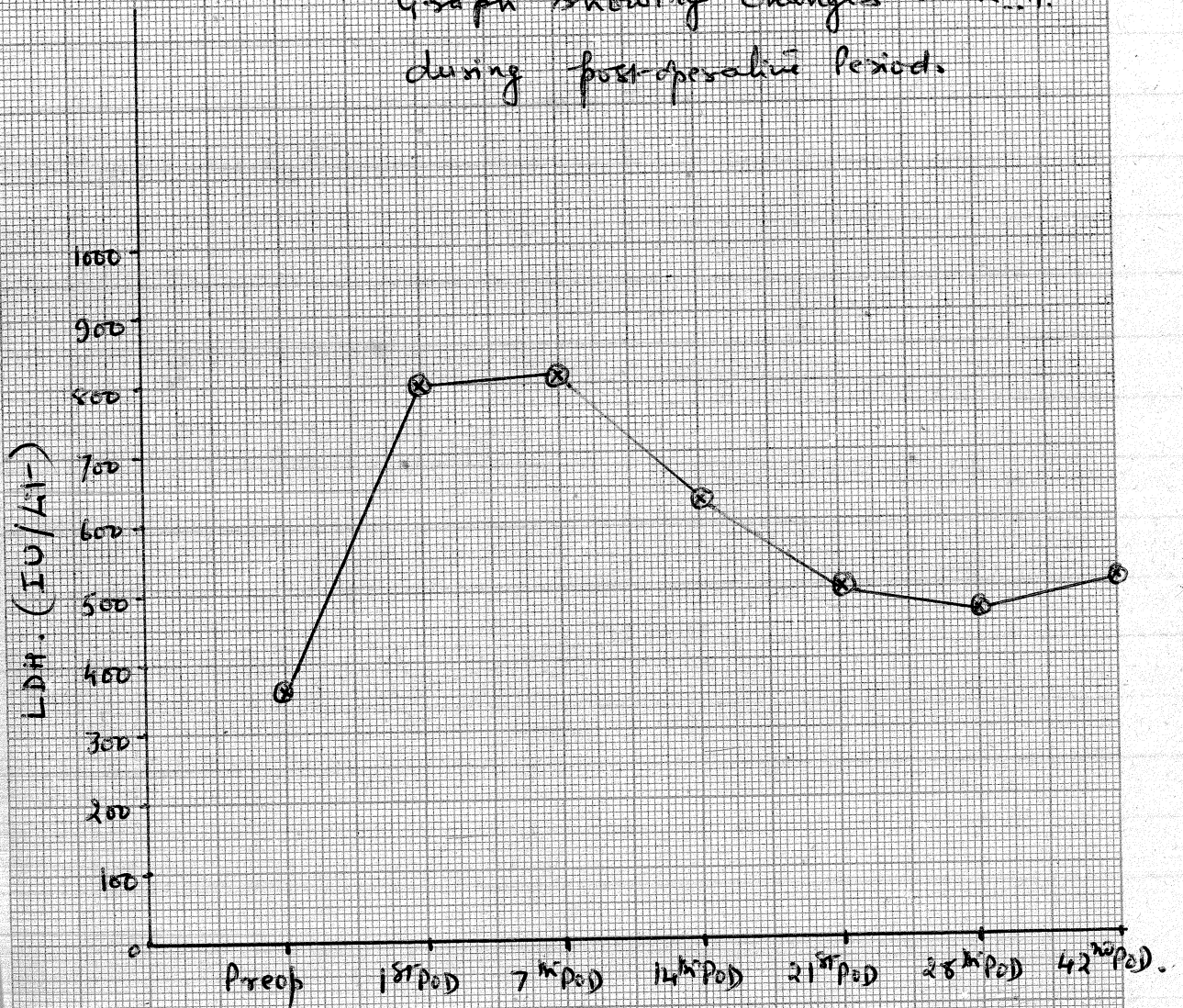


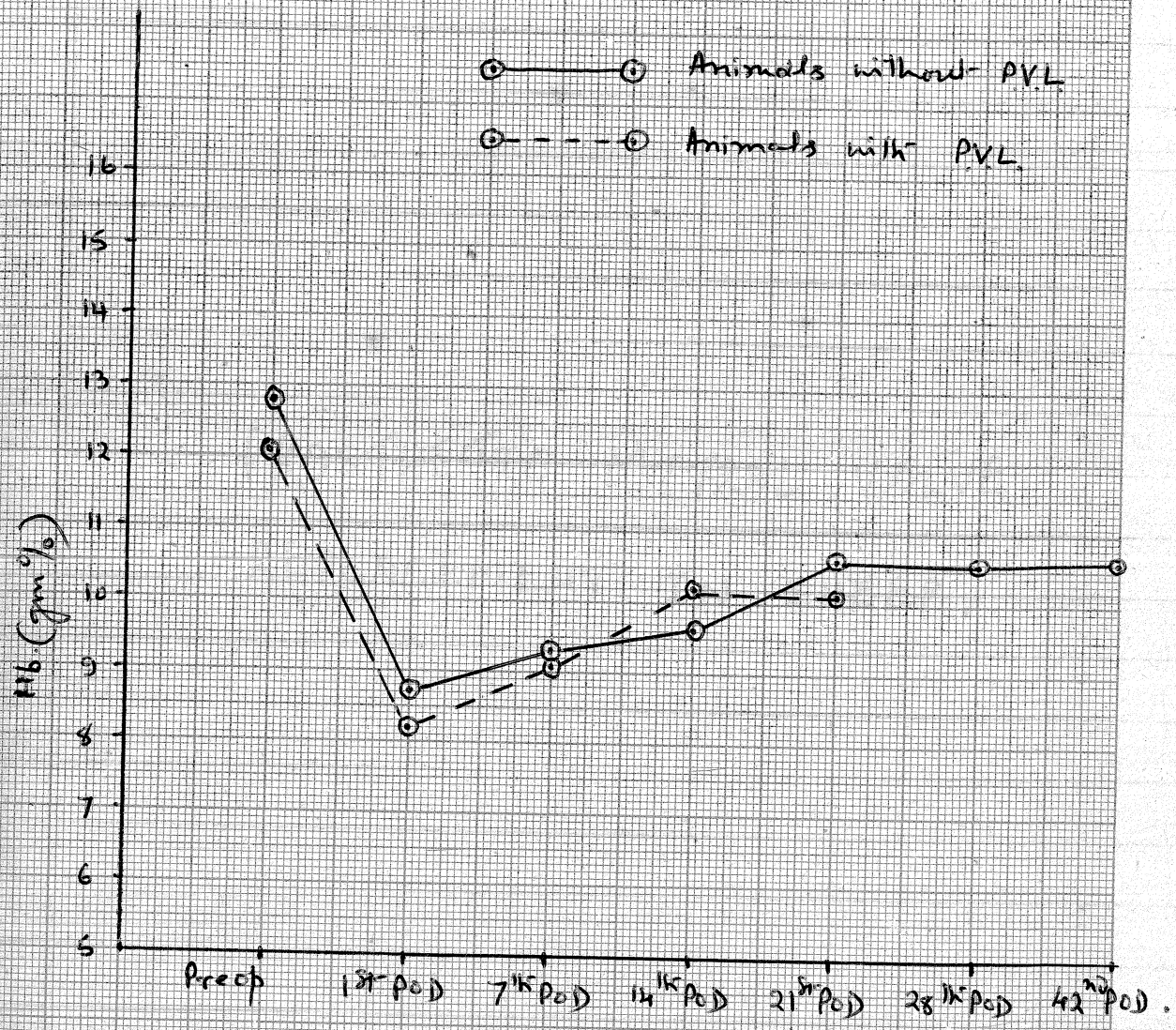
Graph showing changes in Platelet
Count during postoperative period.



Graph no-5

Graph showing changes in LDH during post-operative period.





PROSTHETIC MITRAL VALVE
REPLACEMENT IN SHEEP.

Name	Dr. Bohayar
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Chiba Tilting Disc Valve Prosthesis is being evaluated in sheep. As a first assistant, I have assisted 14 valve replacements in mitral position.

I have written a manual on 'Prosthetic mitral valve replacement in sheep'. The director has gone through this manual. The copy of this manual is submitted to the registrar and to Dr. Arthur.

The total anaesthetic time should be restricted around 3 hours. Dosage of thiopentone and scoline should be administered at minimum.

Accompanying chart gives anaesthetic time, cardiopulmonary bypass time, the dosage of thiopentone and scoline.

Details of operative procedure and post-operative management are given in the manual.

Sheep numbers	Date of Operation	Duration of anaesthesia	Duration of CPB	Outcome of Animal	Total dose of Thiopentone sodium (mg)	Total dose of Propofol (mg)	WT of animal (kg)
18	27.9.85	3 hr 25'	50'	Sacrificed 28.9.85	425	90	26.5
19	10.10.85	3 hr	50'	Sacrificed 01.11.85	300	55	28.5
20	12.10.85	3 hr 10'	65'	Sacrificed 25.10.85	325	65	32.0
21	15.10.85	3 hr	50'	Sacrificed 15.10.85	450	80	37.0
22	17.10.85	3 hr 10'	53'	Sacrificed 18.10.85	575	60	28.0
23	19.10.85	3 hr	50'	Sacrificed 6.12.85	375	80	27.0
24	26.10.85	4 hr	77'	died 4.12.85	425	95	28.0
25	01.11.85	4 hr	75'	Sacrificed 6.12.85	300	50	28.0
26	4.11.85	3 hr 50'	60'	Sacrificed 6.12.85	475	75	28.5
27	15.11.85	3 hr 20'	60'	died 16.2.86	350	70	30.7
28	20.11.85	3 hr 40'	85'	died 22.12.86	425	80	30.5
29	22.11.85	3 hr 15'	48'	died 7.2.86	425	90	29.0
30	27.11.85	4 hr	67'	Sacrificed 28.12.85	500	80	26
31	19.12.85	4 hr	90'	died 6.12.86	500	100	44
Range		3-4 hours	48' - 90'		300-575	50-100	26 - 44
Mean		3 hr. 29'	63.0'		418	76.0	30.25

AUTOPSY

Name	Dr. Pothayar
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Serial No.	Sheep No.	Date of Autopsy	Duration of survival	PROSTHETIC VALVE	ORGAN SYSTEM					Comments	
					Lt. pleura Lung	RE pleura Lung	Liver	Spleen	Kidney		
1	15	6.12.85	87 days	Good Epithelization. Short wear +.	Adhesions present	Normal	Normal	Normal	Normal	Normal	Animal sacrificed shortly
2	16	9.10.85	26 days	Valve thrombosis leading to valve dysfunction.	Edematous. Pleural Effusion + +	Edematous. Pleural Effusion + +	Normal	Normal	Normal	Normal	Animal died of valve thrombosis
3	18	28.9.85	22 hours	Post- of the annulus between 7 and 8 o'clock position left unsealed. Disc function was normal	Edematous Effusion +	Edematous Effusion +	Normal	Normal	Normal	Normal	Animal of passive valvular leak.
4	19	01.11.85	22 days	Vegetations arising from the sewing ring and encroaching over the major orifice leading to valve dysfunction	Edematous Effusion +	Edematous Effusion +	Normal	Normal	Normal	Normal	Animals because of valve dysfunction to vegetations

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Breed	Sex	Date of autopsy	Duration of Survival	PROSTHETIC VALVE	DRYAN SYSTEM					Comments
					L. Lung pleura	R. Lung pleura	Liver	Spleen	Kidney	
5	20	25.10.85	13 days	Vegetations from the sewing ring encroaching over the primary valve orifices. However, disc was freely moving	Edematous Effusion +	Edematous Effusion +	Abscesses +	a small abscess present -	Both kidneys shodded with abscesses	Animal d. of Baclos Endocarditis
6	21	15.10.85	5 hours	Part of the annulus at 2 o'clock position left un sutured. In addition, one suture by the side of it has cut-through.	Edematous	Edematous	normal	normal	normal	Animal d. of flava - valvular leak.
7	23	18.10.85 6.12.85	48 days	Wear of the major strut ++. Good epithelialization. Disc was normal	normal	normal	normal	normal	normal	Animal in sacrificed autopsied
8	22	18.10.85	24 hours	Disc movements normal. no paravalvular leak	Edematous congested	Edematous congested	normal	normal	normal	! Cause of death

Sheep no.	Date of Autopsy	Duration of survival	PROSTETIC VALVE	ORGAN SYSTEM					Comment	
				Left lung filaria	RT lung filaria	Liver	Spleen	Kidneys		
24	4.12.85	39 days	Shut wear ++ disc embolization PVL at 10-12 o'clock position	Edematous froth was oozing out.	congested	normal	normal	normal	Animal died 8 disc embolization. PVL insign. - fixant.	
25	6.12.85	35 days	Good Epithelization. however, it was encroaching over the minor shut. shut wear ++	Normal	normal	normal	normal	normal	Animal was sacrificed deliberately. shut-wear ++	
26	6.12.85	32 days	Exuberant-Epithelization. disc motion normal shut wear ++	normal	normal	normal	normal	normal	Animal was sacrificed deliberately. shut-wear ++	
28	22.12.85	32 days	Exuberant-Epithelization leading to valve dysfunction PVL at 10 o'clock position shut wear ++. disc could be easily disengaged	congested and frothy	congested	normal	normal	normal	Normal	Animal was sacrificed deliberately. shut-wear ++ Valve dys-function such exuberant-epithelization

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Sirel no	Sheep no	Date of autopsy	Survival of Survival	PROSTHETIC VALVE	DIGESTIVE SYSTEM				Comment		
					N. Lung pleura	Ar. pleura lung	Liver	Spleen		Kidney	
13	11	22.12.85	120 days	Disc Embolization. Shut wear + +. Good Epithelialization	Congested and frothy	Congested and frothy	Normal	Normal	Normal	Animal Sied 9 disc embolization	
14	30	28.12.85	31 days	Disc embolization. Shut wear + + Swaging 8 titanium in disc. PVL at 2 o'clock position. Vegetations over sewing ring	Congested and frothy	Congested and frothy	Normal	Normal	Normal	Normal	Animal Sied 9 disc embolization

I, with Dr. Arthur, have personally performed autopsy on sheep with post-operative valve replacement in 14 sheep. The prosthetic valve used was Chiba Tilting Disc valve. Cage was made up of Titanium and the disc of Sapphire.

The details of technique of performing autopsy are given in the manual on 'Prosthetic mitral valve replacement in sheep'.

Out of 14 sheep, 4 sheep were sacrificed deliberately to see the strut wear. The condition of remaining 10 sheep was either precarious or were found dead.

The causes of death is given in the following page

Number of autopsies - 14.
 Sheep sacrificed }
 deliberately } - 4
 Condition precarious }
 or dead } - 10

Cause of death in 10 sheep

Disc Embolization - 3
 Valve Thrombosis - 1
 Bacterial Endocarditis - 1
 Valve Dysfunction due }
 to vegetative growth } - 2
 Paravalvular Leak - 2
 Unknown - 1

Disc Embolization :-

Out of 10 deaths, 3 deaths are due to disc embolization. After the first incident of disc embolization occurred, other 4 animals were sacrificed to see the strut wear. All 4 animals showed the strut wear. In one case, swaging of titanium was found in the disc. The disc embolized within a period of 31 days.

After the disc comes out of cage, it either remains in LV or comes out of aortic valve and gets wedged at the aortic bifurcation.

This is primary prosthetic valve failure and needs change in the prosthetic valve material. Sapphire is harder to Titanium as is evidenced by strut wear and disc embolization.

Valve Thrombosis :-

Out of 10 deaths, one animal died of valve thrombosis. Since it is difficult to monitor the efficacy of anticoagulation and the possible risk of hemorrhage, anticoagulation is not used. Animal died on 26th post-operative day. Since

Other animals did not develop valve thrombosis without anticoagulation, then why only this animal should develop valve thrombosis?

Bacterial Endocarditis :-

Out of 10, one animal died of bacterial endocarditis. The animal had leukocytosis. Autopsy showed vegetations on the sewing ring. However, the disc movement was free. Abscesses were found in liver, spleen and kidneys.

Increasing leukocytes is the guide to diagnose bacterial endocarditis. Infection may promote vegetation formation on the sewing ring. If it is a fulminant infection, the animal dies of septicemia. If the infection is chronic or it is insufficiently treated, vegetation will form over the sewing ring and will ultimately lead to valve dysfunction by encroaching over the primary orifice and obstructing the disc motion. Does valve thrombosis is more common with systemic infection?

Valve Dysfunction due to vegetative growth :-

Out of 10 deaths, 2 are due to valve dysfunction caused by vegetative growth arising from the sewing ring and encroaching over the orifices. Animal no (19) who died on 22nd day, had TLC $21,800/\text{mm}^3$ at the end of 2nd week. Animal no. (28) who died on 32nd post-operative day had TLC $21,000/\text{mm}^3$ at the end of four weeks. It is more likely that chronic infection promotes vegetative formation at the sewing ring.

However, in some animals exuberant epithelization is seen without evidence of infection. Is that due to that growing epithelium connective tissue over the sewing ring doesn't get incorporated?

Paravalvular Leak :-

Out of 14 case assisted, 6 sheep developed paravalvular leak. Out of six, 2 sheep died; one at the end of 5 hours and another at the end of 22 hours after operation.

Visibility of the mitral valve apparatus is very important. It can be improved by proper positioning of the suction canulae and or reducing the pump flow.

Since the valve tissue in which the valve sutures are placed and the valve sutured in place is quite thin, pledgeted sutures should be used.

Paravalvular leak does lead to hemolysis.

The following page gives the details of cause of paravalvular leak and ultimate outcome of the patient animal.

Unknown Cause :-

Out of 10 deaths, one animal had unexplained death. It died at the end of 24 hours of operation.

Paravalvular Leak.

Number of sheep operated for MVR - 14.

Number of sheep who developed PVL - 6.

Number of sheep died of PVL - 2.

Sheep No	Cause of PVL	Outcome
18	Annulus bet'n 7-8 o'clock position left- unsutured	Survived for 22 hours.
21	Annulus at- 2 o'clock position left- unsutured. In addition, one suture by the side of it had given way	Survived for 05 hours.
24	Annulus bet'n 10-12 o'clock position left- unsutured.	PVL insignificant. Animal died of Dsc embolization.
28	Valve suture at- 10 o'clock position cut- through while tying	PVL insignificant- died of valve dysfunction
30	Distance between two ends of suture at sewing ring and annulus was very much unequal	PVL insignificant- died of Dsc embolization.
31	While tying the knot, suture at- 4 o'clock position broke down in two pieces. (Excessive force)	PVL insignificant- died of Dsc embolization.

In Vitro Evaluation. of Chitra Cardiology
Reservoir with Integral Filter.

Name	Dr. Bhojar
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Aim :-

To see the effect of Chitra Cardiology Reservoir with integral filter on the formed elements of blood.

Procedure :-

Polystan Cardiology Reservoir and a Pall filter was used for the comparison.

Blood is taken from the calf by cannulating external jugular vein. This blood was heparinized.

Blood was recirculated through the filters. Hematological investigations were carried out before starting the recirculation, then at the end of one hour for four hours.

The following paper give the details of hematological investigations carried out.

- A — Polystan Cardiology Reservoir and Pall filter
B, C, D, E — Chitra Cardiology Reservoir with integral filter.

A

	Before Circulation	1 hr.	2 hr.	3 hr.	4 hr.
Hb.	7.73	8.0	8.1	7.8	8.0
PCV	22	24	24	23	24
TLC	6,700	6,150	5,500	5,250	5,200
RBC	35,30,000	34,00,000	35,70,000	38,30,000	37,50,000
Platelets	316,000	293,000	205,000	200,000	105,000
Plasma Hb.	14.36	33.25	25.00	27.13	41.5

	Before Circulation	1 hr.	2 hrs	3 hrs	4 hrs
Hb	9.6	9.0	8.4	8.3	9.0
PCV	29	26	25	25	26
TLC	8,000	6,700	5,500	5,500	5,400
RBC	42,30,000	40,50,000	41,50,000	37,40,000	36,80,000
Platelets	340,000	338,000	306,000	245,000	170,000
Plasma Hb.	21.81	28.99	28.46	31.65	32.45

	Before Circulation	1 hr	2 hrs	3 hrs	4 hrs.
Hb	9.6	8.76	9.0	8.9	9.3
PCV	29	26	26	26	27
TLC	5,950	4,850	4,700	4,350	4,350
RBC	43,10,000	40,50,000	39,30,000	37,70,000	35,30,000
Platelets	341,000	305,000	250,000	275,000	166,000
Plasma Hb	23.40	36.71	40.96	37.78	38.57

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	Before Circulation	1 hr.	2 hrs.	3 hrs.	4 hrs.
Hb	7.6	7.5	7.4	7.8	8.0
Pcv	24	22	21	22	24
TLC	5,100	4,350	4,300	4,200	3,700
RBC	36,80,000	28,20,000	33,20,000	31,50,000	30,00,000
Platelets	325,000	314,000	220,000	223,000	144,000
Plasma Hb.	18.35	23.41	82.73	39.63	32.72

	Before Circulation	1 hr	2 hrs	3 hrs	4 hrs
Hb	9.0	8.7	7.7	7.8	8.1
Pcv	28	24	23	23	24
TLC	6,400	4,700	4,300	3,700	3,400
RBC	39,00,000	30,50,000	31,30,000	34,20,000	29,90,000
Platelets	320,000	263,000	255,000	245,000	206,000
Plasma Hb	27.93	42.03	44.16	55.06	46.55

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Conclusions :-

There is marked decrease in platelet count. Leukocytes too get damaged and destroyed, so are the red blood cells which is evidenced by increase in plasma hemoglobin.

However, as compared to Polystyrene cardiomy reservoir, Chitra Cardiomy reservoir is equally efficient.