.....RESULTS

MULTIPLE FRACTURES AND MAJOR SURGERY

SERUM ALBUMIN

Serum Albumin estimation in patients having multiple fractures and major surgery showed significant fall on next day of acute illness compared to control levels. (Table 1). Serial serum albumin in these patients showed significant reduction compared to control on 4th and 8th day of acute illness .The Albumin fall was uniformly comparable in SSGH and BAGH.(Figure 1.2)

As such serum albumin fell uniformly in both major surgery and multiple fracture in first half (2-4th day) and second half (4-8th day) in both the hospitals, except for the patients of multiple fractures in BAGH showed significantly lesser fall in second half as compared to that in major surgery group or even multiple fractures of SSGH. (Table 2) (Figure 1.1)

SERUM TRANSFERRIN

Plasma proteins like Transferrin also showed a definite fall on 2nd day of acute illness in all four groups of patients compared to that of control group in both the hospitals. (Table 3) (Figure 1.3)

In contrast to serum albumin which showed continued fall even in 4^{th} and 8^{th} day, serum transferrin fall was not significant from 4^{th} to 8^{th} day . This was observed in all four groups of patients.(Table 4) (Figure 1.4)

FASTING BLOOD SUGAR AND INSULIN

Fasting blood sugar showed significant rise in Multiple fractures and major surgery patients of SSGH and BAGH compared to control levels. (Table 5) In patients of major surgery of BAGH fasting blood sugar was much higher compared to other patients of multiple fractures of SSGH and BAGH and also of major surgery of SSGH.(Figure 1.5)

Plasma Insulin levels tested concomittently with fasting sugar also showed significant rise in plasma Insulin compared to its control. This was observed in all groups of patients of both the hospitals. (Table 6) (Figure 1.5)

MULTI ORGAN SYSTEM FAILURE

SERUM ALBUMIN

In multi organ failure (MOF) 24 patients were studied where 9 had sepsis with MOF, 6 had Malaria with other infestations, 5 had Cardiac and respiratory failure, 4 had Acute pancreatitis. As compared to major surgery and multiple fracture group most of the patients of MOF had significant higher fall in serum albumin levels on 2^{nd} day compared to control, except for patients with pancreatitis had relatively -lesser but significant fall on 2^{nd} day compared to all other group of MOF. (Table 7) Serial estimation of serum albumin in all these patients reveled significant reduction over eight days period but at slower pace.

The pattern of fall was not uniform in all four groups of patients of MOF. In first

4 days (2^{nd} to 4^{th} day) significant fall of serum albumin was not observed in all 4 subgroups of patients. Only two subgroups (Malaria and other infestations and cardiac and respiratory failure) showed significant fall from 4^{th} to 8^{th} day.(Table 8).But overall there was a significant fall in all 4 subgroups of patients from 2^{nd} to 8^{th} day.Compared to control all 4 subgroups showed significant fall in serum albumin levels on serial estimations.(Figure 2.1 and 2.2)

SERUM TRANSFERRIN

The initial as well as subsequent serial fall in serum transferrin in MOF group of patients was comparable with that in major surgery and multiple fracture group except for those patients who had Malaria and other infestations, who showed profound fall in serum transferrin on day 2 then it fell subsequently at slower pace over 8 days period. (Table 9) (Figure 2.3 and 2.4)

FASTING BLOOD SUGAR AND INSULIN

Fasting blood glucose levels showed a significant rise as compared to control in all four subgroups of patients of MOF. (Table 11) (Figure 2.5)

Fasting Insulin levels tested concomittently with sugar glucose also showed significant and uniform rise in all four subgroups of MOF patients. (Table 12) (Figure 2.5)

HEMATOLOGICAL TESTS

Hematological examination of blood in multiorgan failure patients revealed a significant reduction in Hemoglobin in all four subgroups of patients compared

to control.Whereas total white blood cell count done on admission showed high WBC count in 3 out of 4 subgroups of patients. (Table 13)

The same showed a significant fall in total WBC count in repeat estimation on 8^{th} day of illness. (Table 14)

RENAL FUNCTION TESTS

Renal functions like blood Urea and creatinine estimation in all four subgroups of MOF showed significant rise on day 2 and even persisted on day 8. In subgroups like Malaria and other infestations and Cardiac and Respiratory failure patients serum urea rise was even greater as compared to two other subgroups of MOF.

Serum Creatinine was also raised in all four subgroups of patients on admission and was persisting on 8^{th} day.

Thus all patients of MOF showed variable but significant decrease in renal function as compared to control.(Table 15)

SERUM ELECTROLYTE

Serum Electrolytes like Sodium and Potassium were also estimated. Serum sodium did not change much except in patients with Pancreatitis who showed low serum sodium level persistantly for 8 days.

Serum potassium levels were significantly higher in 3 out of 4 subgroups on admission. Only pancreatitis patients showed relatively lower levels of serum potassium. When seen on 8^{th} day serum potassium was in its normal range in all four subgroups. (Table 16)

ARTERIAL BLOOD GAS ANALYSIS

Arterial blood gas analysis was carried out frequently in these patients of MOF, we have noted ABG at the onset of illness.

Arterial pH was towards acidosis in two out of four subgroups (Sepsis with MOF and Cardiac and Respiratory failure). In malaria and other infestations and pancreatitis it showed normal range.

Carbon dioxide expressed in form of partial pressure of carbon dioxide in mm. of Hg showed significantly lower pressure (Hypocapnia) in arterial blood in all four subgroups of patients compared to control.

Partial pressure of Oxygen in arterial blood showed significantly lower levels in 3 out of 4 subgroup of MOF. Only patients with Malaria and other infestation showed partial pressure of oxygen in normal range compared to control.

Serum bicarbonate levels were significantly lower in all four subgroups of patients as compared to control. The patient group having cardiac and respiratory failure showed serum bicarbonate even much lower compared to other three subgroups of MOF.

Percentage saturation of oxygen in arterial blood correlates with oxygenation of hemoglobin that showed parallel fall in all four groups of MOF as per their partial oxygen pressure (Table 17).

Thus overall arterial blood biochemistry showed association of Acidosis, Hypocapnia, Hypoxemia in majority of the patients of MOF.

Average clinical course of patients who had multiple fractures and those having undergone major surgery in SSGH and BAGH, was quite uneventful. Almost none of the patients had any morbidity or mortality. But in patients having multiple organ system failure in Intensive Care Unit of BAGH seven patients

died out of twenty four. Overall clinical course of these patients was complicated with infection, vital organ dysfunction and nutritional problems. Those who survived had prolonged course of recovery on follow-up.

Table 1 Serum albumin* levels in SSGH and BAGH

Serum Albumin	SSGH			BAGH		
	2nd Day	4th Day	8th Day	2nd Day	4th Day	8th Day
Control	4.28 ± 0.154^{f}	4.06 ± 0.158^{f}	4.12 ± 0.158^{f}	4.35 ± 0.135^{f}	4.11 ± 0.146^{f}	4.09 ± 0.145^{f}
Multiple Fractures	3.41 ± 0.039^{e}	2.99 ± 0.097^{d}	2.29 ± 0.085^{ab}	3.62 ± 0.085^{e}	3.07 ± 0.112^{d}	2.82 ± 0.124^{bcd}
Major Surgery	3.43 ± 0.037^{e}	2.84 ± 0.092^{cd}	2.27 ± 0.011^{a}	3.50 ± 0.065^{e}	2.97 ± 0.075^{d}	2.69 ± 0.048^{abc}

* Expressed as g /dl

Values with same superscript are not statistically significant

Table 2 Percentage difference in serum albumin levels in patients of SSGH and BAGH

Serum Albumin	SSGH		BAGH	
	2-4 Days	4-8 Days	2-4 Days	4-8 Days
Control	5.2% ↓ NS	1.2% ↑ NS	5.5% ↓ NS	0.5% ↓ NS
Multiple Fractures	12.2% ↓ * +	16.8% ↓ * +	15.2% ↓ * +	8.3% ↓ NS +
Major Surgery	17.3% ↓ * +	19.0% ↓ * +	15.0% ↓ * +	12.9% ↓ * +

* Significant $p<0.05$ compared to the preceding day

\+ Significant $p<0.05$ compared to controls

Table 3 Serum transferrin* levels in SSGH and BAGH

Serum Transferrin	SSGH			BAGH		
	2nd Day	4th Day	8th Day	2nd Day	4th Day	8th Day
Control	351.65 ± 11.05^{c}	339.05 ± 9.63^{c}	334.75 ± 7.709^{c}	351.45 ± 10.95^{c}	338.75 ± 9.54^{c}	332.30 ± 8.618^{c}
Multiple Fractures	210.95 ± 5.71^{b}	170.65 ± 7.16^{a}	160.40 ± 5.57^{a}	203.85 ± 5.05^{b}	172.05 ± 5.83^{a}	157.85 ± 4.63^{a}
Major Surgery	198.85 ± 4.96^{b}	173.50 ± 3.49^{a}	159.55 ± 2.37^{a}	205.30 ± 5.32^{b}	174.00 ± 3.24^{a}	159.40 ± 2.81^{a}

* Expressed as mg / dl

Values with same superscript are not statistically significant

Table 4 Percentage difference in serum transferrin levels in patients of SSGH and BAGH

Serum Transferrin	SSGH		BAGH	
	2-4 Days	4-8 Days	2-4 Days	4-8 Days
Control	3.6% NS	1.3% NS	3.6% NS	1.9% NS
Multiple Fractures	19.1% * + ↓	6.0% + ↓	15.6% * + ↓	8.3% + ↓
Major Surgery	12.8% * + ↓	8.0% + ↓	15.3% * + ↓	8.4% + ↓

* Significant $p<0.05$ compared to the preceding day

\+ Significant $p<0.05$ compared to controls

Table 5 Fasting blood sugar* levels in SSGH and BAGH

F. Blood Sugar	SSGH	BAGH
Control	108.30 ± 2.933^{a}	110.10 ± 3.38^{a}
Multiple Fractures	134.50 ± 3.776^{b} ↑	137.95 ± 2.733^{b} ↑
Major Surgery	138.65 ± 6.99^{b} ↑	173.55 ± 18.815^{c} ↑

* Expressed as mg / dl

Values with same superscript are not statistically significant

Table 6 Fasting serum insulin* levels in SSGH and BAGH

F. S. Insulin	SSGH	BAGH
Control	1.90 ± 0.191^{a}	11.85 ± 0.244^{a}
Multiple Fractures	18.30 ± 0.442^{b} ↑	18.75 ± 0.523^{bc} ↑
Major Surgery	18.80 ± 0.501^{bc} ↑	19.85 ± 0.882^{c} ↑

* Expressed as μ U / ml

Values with same superscript are not statistically significant

Table 7 Serum Albumin* levels in MSOF paients of BAGH

Albumin	2nd Day	4th Day	8th Day
Control	4.351 ± 0.136^{i}	4.113 ± 0.146^{hi}	4.091 ± 0.145^{hi}
Infection and MOF	3.118 ± 0.007^{def}	2.633 ± 0.071^{bcd}	2.100 ± 0.044^{abc}
Malaria and other Infestations	3.020 ± 0.24^{de}	2.680 ± 0.204^{cd}	2.040 ± 0.116^{ab}
Cardiac & Respiratory Failure	3.116 ± 0.048^{de}	2.583 ± 0.070^{bcd}	1.950 ± 0.010^{a}
Pancreatitis	3.730 ± 0.025^{fgh}	3.40 ± 0.071^{efg}	2.930 ± 0.063^{de}

* Expressed as g / dl

Values with same superscript are not statistically significant

Table 8 Percentage difference in serum albumin levels in MSOF patients of BAGH

Albumin	2-4 Day		4-8 Day		2-8th Day	
Control	5.5%	NS	0.5%	NS	6.0%	NS
Infection and MOF	17.4%	↓ +	20.2%	↓ +	34.1%	↓ * +
Malaria and other Infestations	11.3%	↓ +	23.9%	↓ +	32.5%	↓ * +
Cardiac & Respiratory Failure	17.1%	↓ +	24.5	↓ +	37.5%	↓ * +
Pancreatitis	8.8%	↓ +	13.8	↓ +	21.4	↓ * +

* Significant $p<0.05$ compared to the preceding day

\+ Significant $p<0.05$ compared to controls

Table 9 Serum Transferrin* levels in MSOF patients of BAGH

Transferrin	2nd Day	4th Day	8th Day
Control	351.45 ± 10.953^{e}	338.75 ± 9.535^{e}	332.30 ± 8.362^{e}
Infection and MOF	205.56 ± 3.96^{bcd}	177.56 ± 5.68^{abc}	164.00 ± 4.40^{ab}
Malaria and other Infestations	175.40 ± 6.85^{abc}	167.80 ± 4.99^{abc}	155.80 ± 6.04^{a}
Cardiac & Respiratory Failure	209.66 ± 3.85^{cd}	174.83 ± 2.74^{abc}	159.17 ± 3.62^{a}
Pancreatitis	220.00 ± 4.55^{d}	189.50 ± 4.09^{abcd}	179.00 ± 2.65^{abcd}

* Expressed as mg / dl

Values with same superscript are not statistically significant

Table 10 Percentage difference in serum transferrin levels in MSOF patients of BAGH

Transferrin	2-4 Day		4-8 Day		2-8 Day	
Control	3.5 %	NS	1.5 %	NS	5.5 %	NS
Infection and MOF	13.6 % ↓	+	7.6 % ↓	+	20.2 % ↓	+
Malaria and other Infestations	4.3 % ↓	+	7.2 % ↓	+	11.2 % ↓	+
Cardiac & Respiratory Failure	16.6 % ↓	+	9.0 % ↓	+	24.1 % ↓	* +
Pancreatitis	13.9 % ↓	+	5.6 % ↓	+	18.6 % ↓	+

* Significant $p<0.05$ compared to the preceding day

\+ Significant $p<0.05$ compared to controls

Table 11 Fasting blood sugar* levels in MSOF patients of BAGH

F. Blood Sugar	Control	Infection and MOF	Malaria and other Infestations	Cardiac & Respiratory Failure	Pancreatitis
	110.65 ± 2.095^{a}	156.11 ± 6.347^{b} ↑	144.60 ± 2.502^{b} ↑	168.83 ± 26.225^{b} ↑	144.25 ± 4.662^{b} ↑

*Expressed as mg / dl

Values with same superscript are not statistically significant

Table 12 Fasting serum insulin* levels in MSOF patients of BAGH

F. S. Insulin	Control	Infection and MOF	Malaria and other Infestations	Cardiac & Respiratory Failure	Pancreatitis
	11.85 ± 0.244^{a}	20.33 ± 1.080^{d} ↑	17.00 ± 0.316^{b} ↑	19.66 ± 0.919^{cd} ↑	18.00 ± 0.707^{bc} ↑

* Expressed as μ U / ml

Values with same superscript are not statistically significant

Table 13 Haemoglobin *levels in MSOF patients of BAGH

Hb.	Control	Infection and MOF	Malaria and other Infestations	Cardiac & Respiratory Failure	Pancreatitis
	15.25 ± 0.376^{a}	12.50 ± 0.696^{b}	7.38 ± 0.440^{c}	11.90 ± 0.548^{b}	12.5 ± 0.556^{b}

* Expressed as g / dl

Values with same superscript are not statistically significant

Table 14 Total WBC* count in MSOF patients of BAGH

TC	Control	Infection and MOF	Malaria and other Infestations	Cardiac & Respiratory Failure	Pancreatitis
On Admission	8240.00 ± 179.82^{a}	20755.00 ± 2181.43^{d}	12560.00 ± 515.36^{bc}	10180.00 ± 677.05^{ab}	18275.00 ± 1653.97^{c}
8th Day	8185.00 ± 185.14^{b}	$12722.00 \pm 1230.15^{bc}$	14800.00 ± 1617.09^{c}	10100.00 ± 864.86^{ab}	9900.00 ± 685.56^{ab}

* Expressed as cu mm.

Values with same superscript are not statistically significant

Table 16 Serum electrolytes (sodium and potassium)* in MSOF patients of BAGH

Sodium	Control	Infection and MOF	Malaria and other Infestations	Cardiac & Respiratory Failure	Pancreatitis
On Admission	139.90 $\pm 0.821^{cde}$	140.22 ± 2.190^{cde}	132.80 ± 1.854^{b}	144.80 ± 1.392^{e}	115.00 ± 1.779^{a}
8th Day	139.95 $\pm 0.982^{cde}$	136.22 ± 2.782^{bcd}	135.20 ± 2.416^{bc}	141.66 ± 0.760^{de}	117.00 ± 2.121^{a}
Potassium	**Control**	**Infection and MOF**	**Malaria and other Infestations**	**Cardiac & Respiratory Failure**	**Pancreatitis**
On Admission	4.13 ± 0.089^{b}	5.00 ± 0.209^{cd}	5.220 ± 0.086^{cd}	5.38 ± 0.182^{d}	3.15 ± 0.096^{a}
8th Day	4.151 ± 0.088^{b}	4.14 ± 0.146^{b}	4.980 ± 0.093^{cd}	4.82 ± 0.137^{c}	3.98 ± 0.095^{a}

* Expressed as meq / l

Values with same superscript are not statistically significant

Table 17 Arterial blood gas analysis in MSOF patients of BAGH

ABG	Control	Infection and MOF	Malaria and other Infestations	Cardiac & Respiratory Failure	Pancreatitis
PH	7.40 ±0.003^{b}	7.138 ±0.031^{a}	7.40 ±0.028^{b}	7.16 ±0.031^{a}	7.42 ±0.016^{b}
PCO2 mm of Hg	40.05 ±0.285^{c}	27.14 ±1.124^{b}	24.18 ±0.483^{a}	27.36 ±0.553^{b}	26.45 ±0.603^{b}
PO2 mm of Hg	94.60 ±0.407^{b}	77.42 ±6.391^{a}	93.20 ±0.80^{b}	73.50 ±2.997^{a}	73.80 ±2.98^{a}
S.HCO3 meq / l	23.90 ±0.228^{c}	18.77 ±1.071^{b}	19.40 ±1.177^{b}	14.46 ±0.874^{a}	20.35 ±0.810^{b}
SaO2 %	96.70% ±0.262^{c}	90.27% ±3.022^{ab}	95.12% ±0.943^{bc}	87.66% ±2.641^{a}	92.75% ±0.75^{abc}

Values with same superscript are not statistically significant

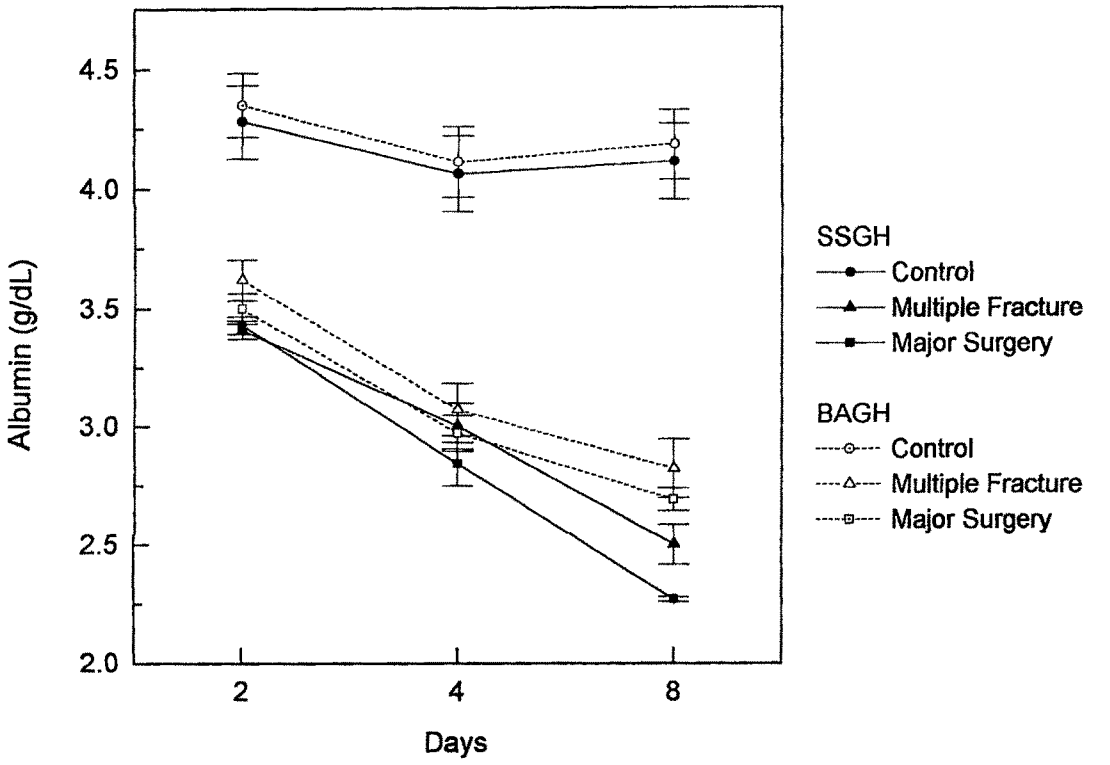

FIGURE I.1. Serum Albumin Level in patients admitted at Shri Sayaji General Hospital (SSGH) and Bhailal Amin General Hospital (BAGH) with multiple fracture and major surgery.

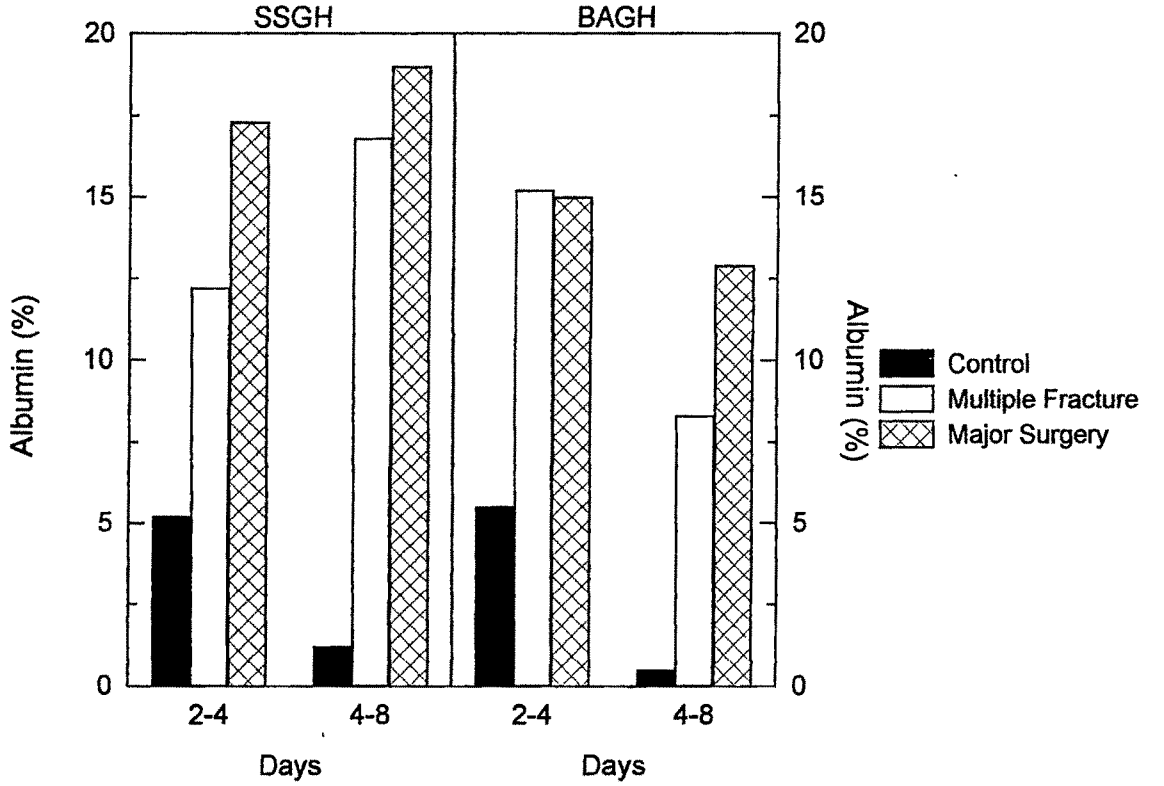

FIGURE I.2 Percentage difference in albumin level between 2 & 4 and 4 & 8 day of admission.

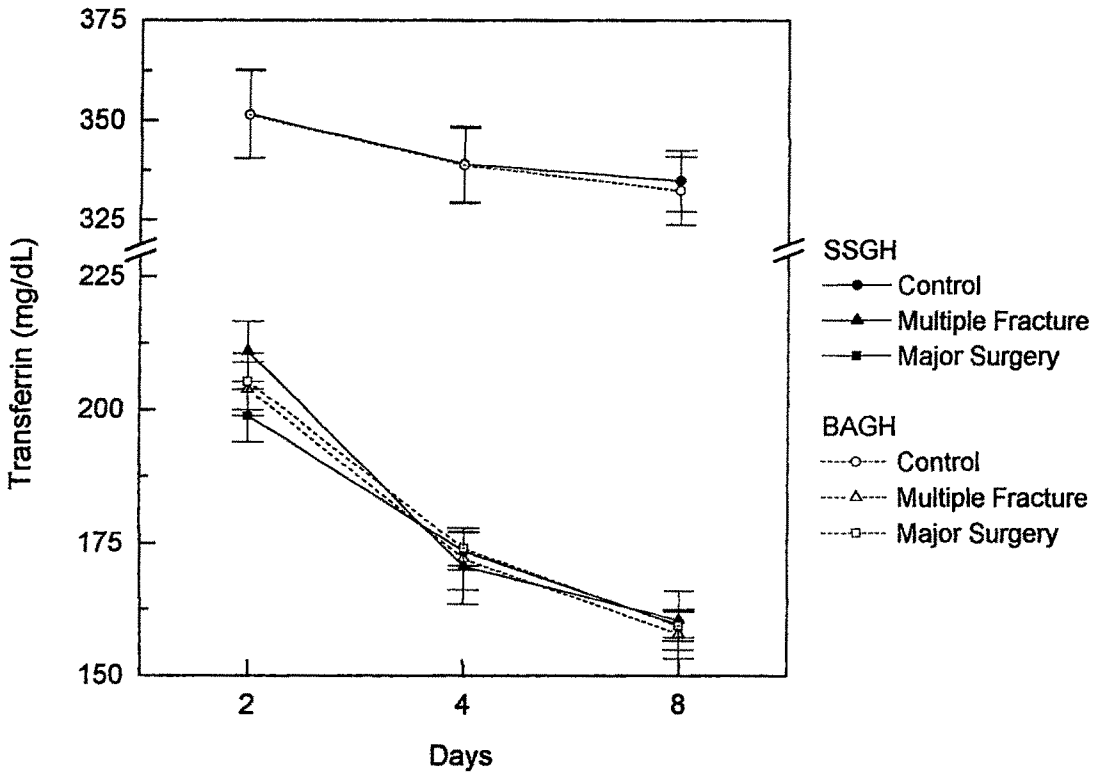

FIGURE I.3. Serum Transferrin Level in patients admitted at Shri Sayaji General Hospital (SSGH) and Bhailal Amin General Hospital (BAGH) with multiple fracture and major surgery.

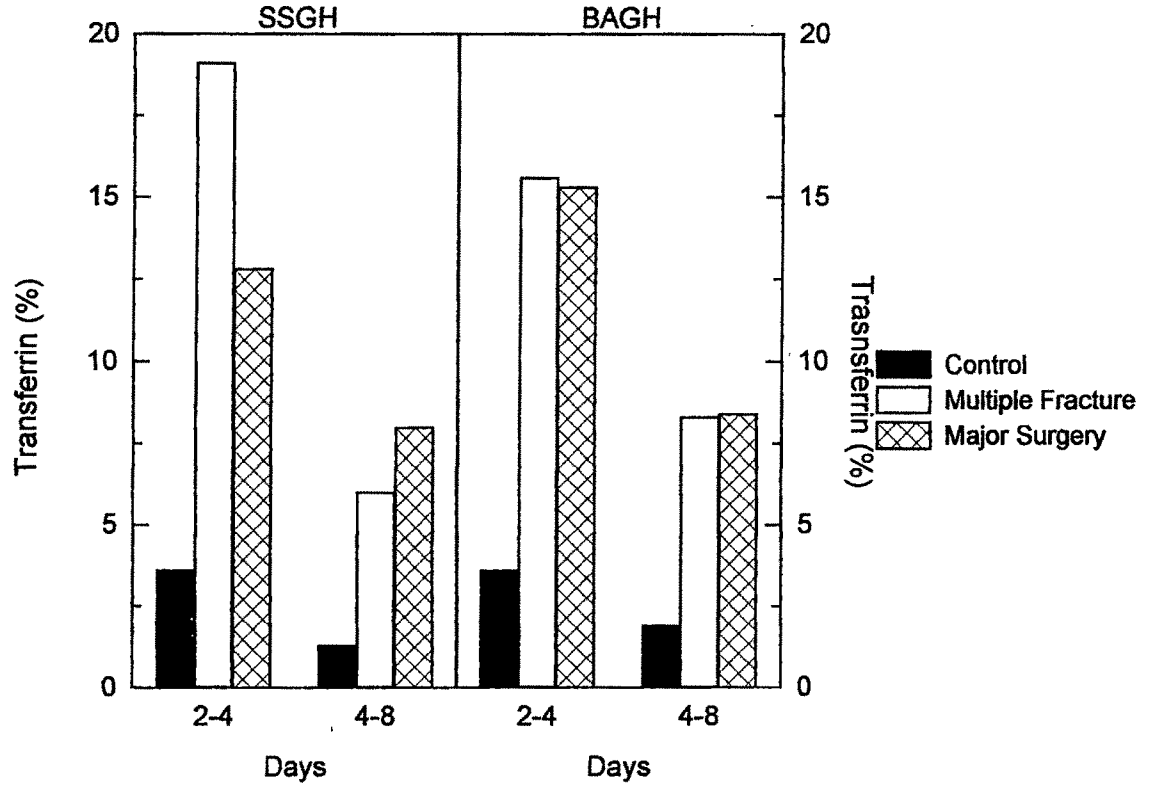

FIGURE I.4 Percentage difference in Transferrin level between 2 & 4 and 4 & 8 day of admission.

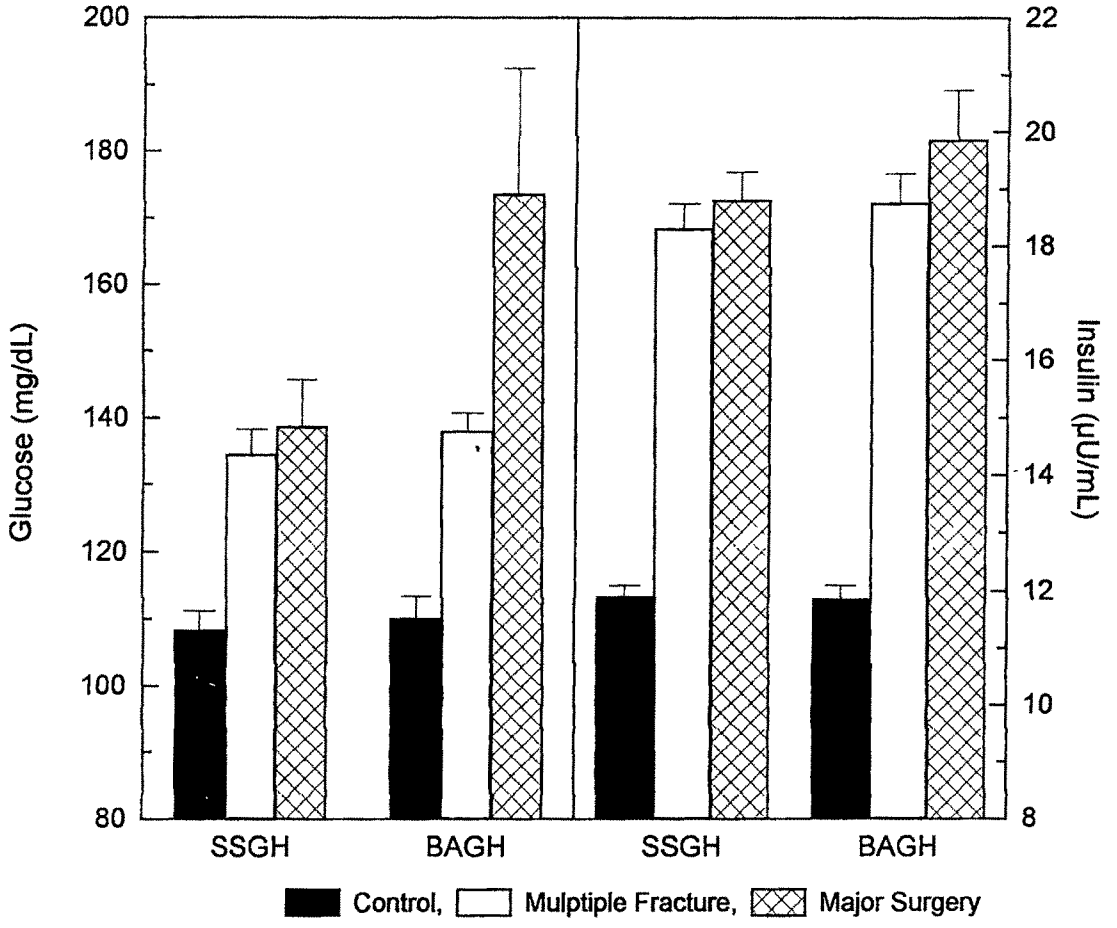

FIGURE I.5. Serum Glucose and Insulin Level in patients admitted at Shri Sayaji General Hospital (SSGH) and Bhailal Amin General Hospital (BAGH) with multiple fracture and major surgery.

FIGURE 2.1. Serum Albumin Level in patients admitted at BAGH with multi organ failure (MOF)

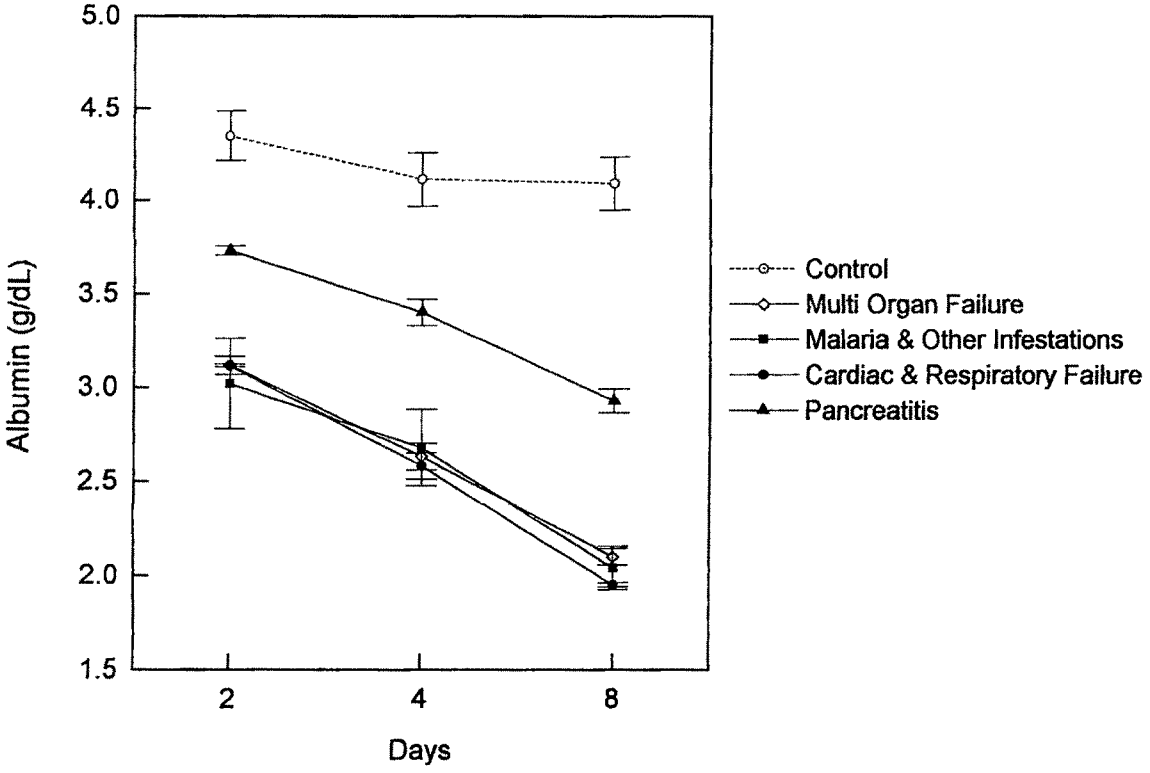

FIGURE 2.2. Percentage difference in Serum Albumin Level in patients admitted at BAGH with multi organ failure (MOF)

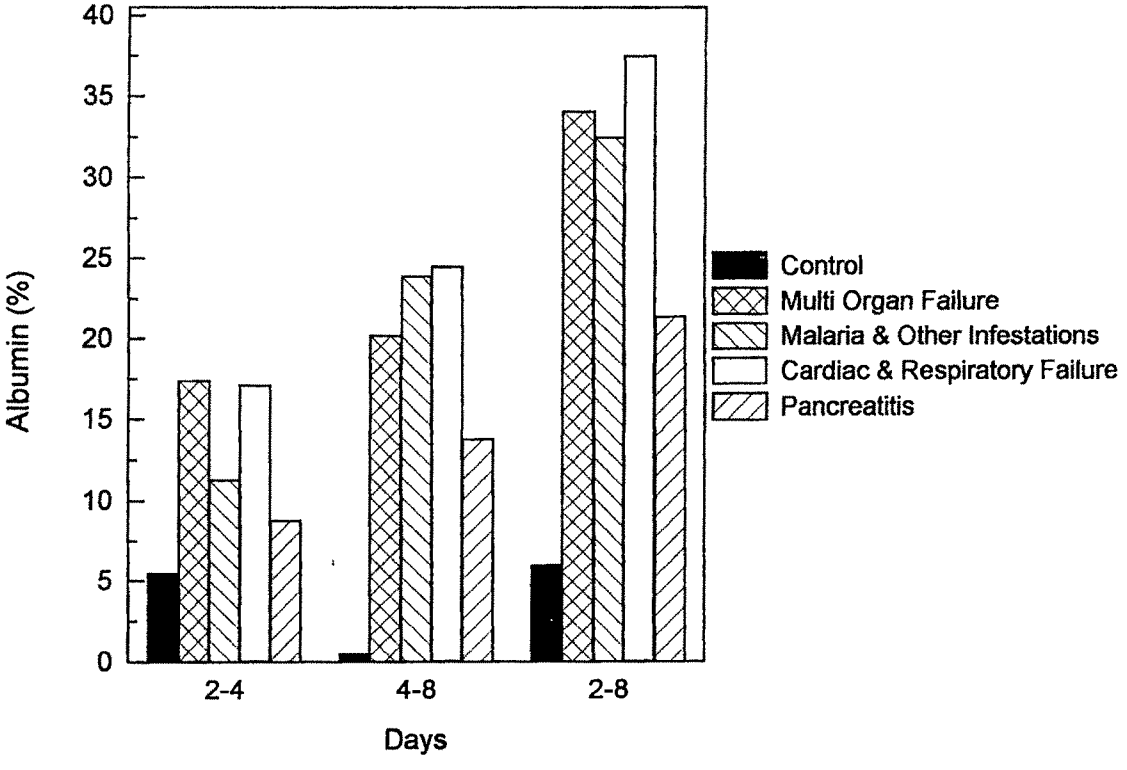

FIGURE 2.3. Serum Transferrin Level in patients admitted at BAGH with multi organ failure (MOF)

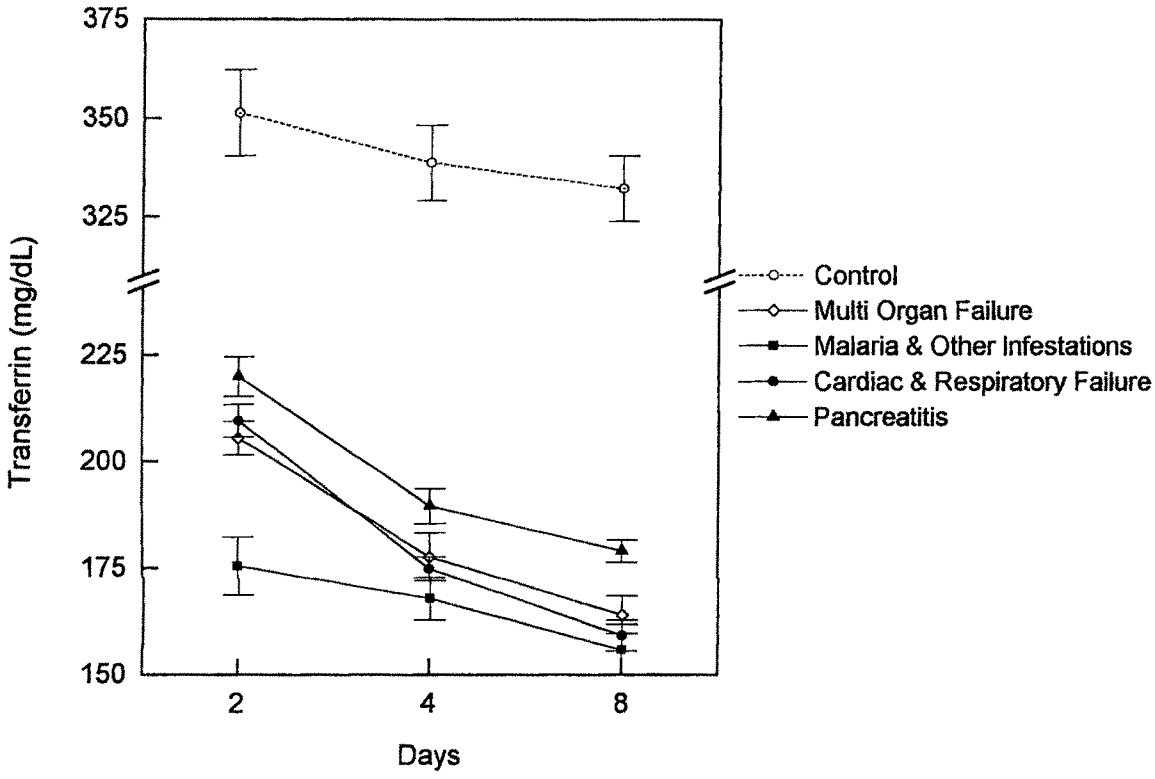

FIGURE 2.4. Percentage difference in Serum Transferrin Level in patients admitted at BAGH with multi organ failure (MOF)

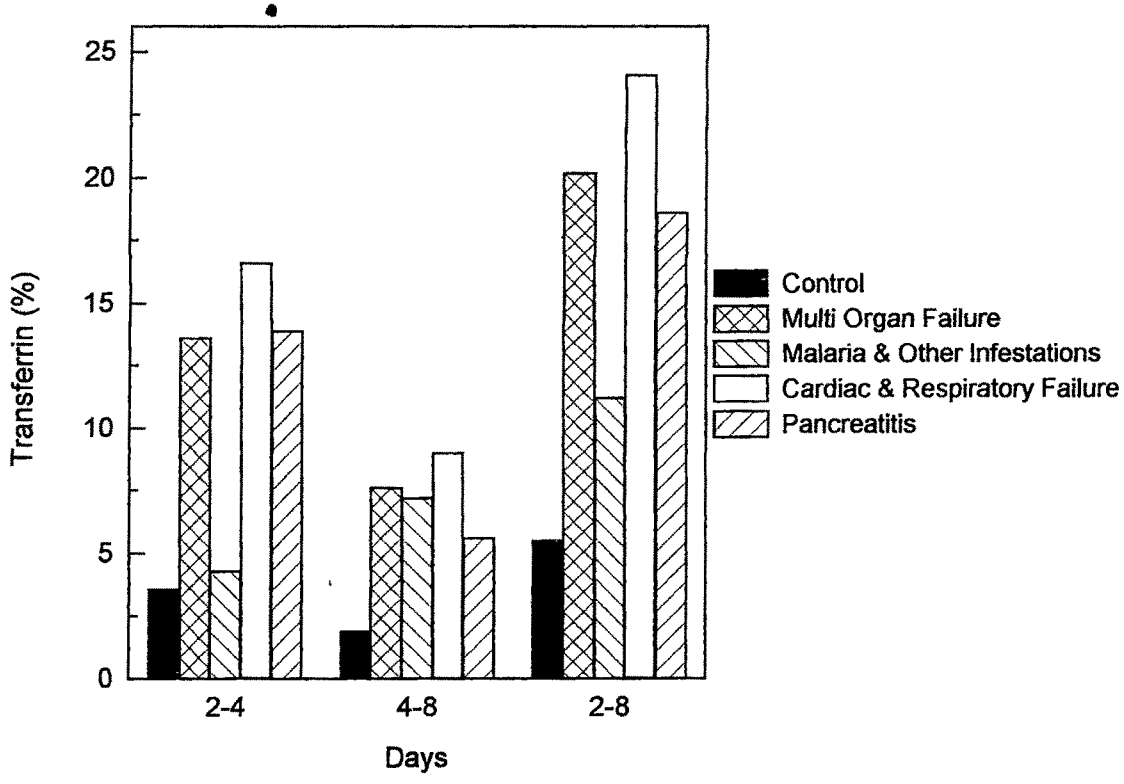

FIGURE 2.5. Serum Glucose and Insulin Level in patients admitted at BAGH with multi organ failure (MOF)