THE EFFECT OF MAJOR ORTHOPAEDIC SURGERY ON THE NUTRITIONAL STATUS OF THE PATIENTS

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A dissertation submitted to the Tamil Nadu Dr.M.G.R. Medical University in partial fulfillment of the requirement for the award of M.S. Branch II (Orthopaedic Surgery) degree

March 2006-2009

CERTIFICATE

This is to certify that this dissertation titled **" THE EFFECT OF MAJOR ORTHOPSEDIC SURGERY ON THE NUTRITIONAL STAUTUS OF THE PATIENTS "** is a bonafide work done by **Dr. SHAHID PATHOOR ,** in the Department of Orthopaedic Surgery, Christian Medical College and Hospital, Vellore in partial fulfillment of the rules and regulations of the Tamil Nadu Dr. M.G.R. Medical University for the award of M.S. Degree (Branch-II) Orthopaedic Surgery under the supervision and guidance of **Prof. G.D.SUNDARARAJ** during the period of his post-graduate study from March 2006 to February 2009.

This consolidated report presented herein is based on bonafide cases, studied by the candidate himself.

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INTRODUCTION

Protein-energy malnutrition (PEM) is a chronic or acute lean body protein loss that leads to a state of specific nutrient deficiency that produces a measurable change in body function[1]. PEM is a clinical condition characterized by depletion of muscle/body fat and visceral proteins. PEM is associated with a worse outcome during illness and may be reversed by conversion to an anabolic state. PEM is common in hospitalized patients and is associated with increased mortality[2,3]. 30%– 60% of patients hospitalized for acute illness are malnourished, and nutritional status has been shown to deteriorate during hospitalization [4] . Reasons for this high prevalence include poor recognition and monitoring of nutritional status and inadequate intake of nutrients during hospitalization[1] . Malnutrition is also major problem among residents in long-term care facilities. Furthermore, patients admitted to the hospital may already be malnourished or at risk of malnutrition[5].

Trauma and surgery induce extensive physiological changes, commonly denominated the acute phase reaction (APR). This APR is activated by various kinds of stimuli, namely nociceptive stimulations, tissue injury, tissue ischaemia and reperfusion as well as by haemodynamic disturbances which occur commonly in such patients. APR is mainly characterised by the release of counter-regulatory hormones, complex

metabolic changes and by the hepatic synthesis of numerous acute phase factors (C-reactive protein, haptoglobin, complement protein, etc). There is a resistance to the nutritional support . In patients with non complicated surgery and low or moderate severity trauma , the metabolic changes are minor and self-limited . Conversely , in patients with complicated surgery or major trauma , there is an extensive APR, which can be very prolonged. This results in important and sustained metabolic changes, leading to extensive catabolism and progressive loss of body cell mass. The latter is amplified by the decreased body ability to adapt to starvation and by the resistance to the nutritional support that typically occur in complicated postoperative and trauma patients[6].

AIMS AND OBJECTIVES

The aims and objectives of the study are

- To **prospectively** study the effect of major elective orthopaedic surgery on the nutritional status of patients.
- To analyse how the nutritional markers behave pre op, post op and at 3 months follow up in patients undergoing major elective orthopaedic surgery.
- To analyse the effect of nutritional status on the wound related complications and other post op complications like UTI.
- To compare changes in the pattern of the nutritional parameters between the patients undergoing different types of major elective orthopedic surgery.
- To evaluate the time taken for the nutritional parameters to normalise.

REVIEW OF LITERATURE

Malnutrition results either from inadequate intake or increased energy needs during illness[6]. It causes loss of both body fat and lean body mass including muscle[7]. It is known that humans do not survive once their body cell mass (fat free portion of muscle, viscera, and immune system) drops below 60% of the normal levels of young adult[8]. Thus severe wasting results in death. However factors such as trauma , ageing and chronic diseases that are not directly related to malnutrition also results in body wasting[7,9].

The trauma of injury or surgery causes production of catabolic cytokines resulting in increased expenditure and break down of protein stores , including muscle[10]. These changes support the activation of inflammatory and reparative mechanisms and promote recovery[10-12] . Healthy individuals who are adequately nourished generally move through the catabolic phase in to the reparative phase and recover with out serious consequences.

In patients who are undernourished , especially with respect to protein, the nutrients required for recovery compete with those necessary for maintaining or restoring lean tissue mass[13]. If the metabolic responses are particularly intense or prolonged , they can result in nutritional depletion in undernourished patients which lead to poor clinical outcome[14].Thus there

appear to be a fine balance between the normal metabolic response to injury that promotes recovery and maintaining sufficient protein reserves in the body to allow recovery of physical function and prevent death.

The effects of ageing further complicate this relationship. Ageing is associated with decreases in muscle mass and increased likelihood of chronic diseases. Thus even adequately nourished elderly people recover from trauma and surgery more slowly than adult[15]. However malnutrition is common in the elderly[16-19]. Studies in animals and humans have demonstrated that ageing results in defects in adaptation to long term dietary restrictions, manifested by more pronounced loss of weight and lean body mass compared to younger adults and further compromises the already decreased muscle function and immune response observed in the elderly[20-24].

The catabolic state and the inflammatory reaction that occur in response to the trauma of both the fracture and surgery is particularly severe in hip fracture patients. It persist for several months and is dramatically higher than in nonsurgical elderly patients[25-28]. Hospitalized hip fracture patients have lower nutrient intake than the elderly control population[29,30]. Thus the prolonged inflammatory response may be related to the state of malnutrition in these patients. It results in loss of skeletal muscle mass ,

visceral protein and immunocompetence . It could induce a downward frailty cycle that may lead to dysfunction or death in certain patients[31,32].

Thus malnutrition , trauma , surgery and ageing not only contribute independently but also interact to promote loss of muscle mass. However malnutrition also results in impairment of cellular , immune and muscle function[33,34]. The changes in muscle function occur more quickly than the changes in the muscle mass in response to both decreased nutrient intake and refeeding. The changes in the muscle function are independent of the disease or inflammatory states caused by the trauma of injury or surgery. These changes in the muscle function may be more indicative of pure malnutrition than are the changes in the body composition[35,36].

Incidence of malnutrition in orthopaedic inpatients

There are various studies on the incidence of under nutrition in hospitalized patients. Most of them give figures around 40 %[37-41]. The effect of malnutrition in hip fractures especially in elderly is extensively studied and these studies show prolonged hospital stay and complications in the malnourished patients[42-45].

Nutritional markers

The nutritional markers can be classified in to two groups

1. Anthropometric markers

2. Biochemical markers.

The anthropometric markers are the most widely used and non-invasive method of assessing the nutritional status[46]. The anthropometric markers commonly used are Body Mass Index (BMI) , Mid Upper Arm Circumference (MUAC) and Triceps Skin Fold thickness (TSF).

BMI is calculated by the following formula –

$$BMI = \frac{\text{Weight in kilogram}}{(\text{Height in metre})^2}$$

A value less than 19.99 is considered as undernourished.

20 to 24.99 is considered as adequately nourished

25 to 29.99 is considered as over weight

30 to 39.99 is considered as obese

>/= 40 is considered as morbidly obese

BMI is the most accurate form of anthropometric measurement for assessing nutrition[47].

MUAC is measured With the subject's forearm held in horizontal position. The lateral part of the upper arm is marked at the midpoint between the acromion process and the lateral epicondyle of the humerus. Care must be exercised to maintain the tape in a horizontal plane and to avoid distortion of the skin surface. The circumference is measured to the nearest mm at the marked midpoint[48].

TSF is measured by the following procedure. A fold of skin plus subcutaneous tissue (without underlying muscle) is formed over the triceps muscle with the thumb and the index finger of the non dominant hand at the same vertical position where the mid-upper arm circumference is measured. The crest of the fold is parallel to the long axis of the arm. The thickness of the fold is measured with a vernier caliper held in the dominant hand, without releasing the fold from between the thumb and the index finger of the non dominant hand. Measurements are recorded to the nearest mm[39].

The final measurement, in both MUAC and TSF, is taken by taking the average of three readings. Even though they are very easy and cheap method, both these measurements are highly observer dependant and are inaccurate[39].

The normal values for the MUAC and TSF are the following[49]-

Normal TSF –Male -9.2 +/- 3.2 mm

Females -17.1 +/- 5.5 mm

Normal MUAC – Male -28.4 +/- 2.5 cm

Females – 26.6 +/-3.5 cm

The biochemical markers commonly used for nutritional assessment are total lymphocyte count (TLC), albumin, prealbumin (PA) , transferrin

(TF) . Among these pre albumin and transferring are found to be more accurate in assessing the nutritional status than the others[5].

Normal range for the biochemical markers are –

TLC- 1000 to 3500 / dl

Albumin - 3.4 to 5.4 g/dl

PA - > 20 mg/dl

TF – 200 to 400 mg/dl

Albumin is the most abundant blood plasma protein and is produced in the liver and forms a large proportion of all plasma protein. it normally constitutes about 60% of human plasma protein. It has a molecular weight of about 65kD (65,000 Atomic mass units) and consists of 584 amino acids and contains no carbohydrate. Serum albumins are important in regulating blood volume by maintaining the oncotic pressure(also known as colloid osmotic pressure) of the blood compartment. They also serve as carriers for molecules of low water solubility, this way isolating their hydrophobic nature, including lipid soluble hormones, bile salts, unconjugated bilirubin, free fatty acids(apoprotein), calcium, ions (transferrin), and some drugs like warfarin, phenobutazone, clofibrate & phenytoin. For this reason, it's sometimes referred as a molecular "taxi". Competition between drugs for

albumin binding sites may cause drug interaction by increasing the free fraction of one of the drugs, thereby affecting potency[50,51].

Transferrin is a blood plasma protein for iron ion delivery that, in humans, is encoded by the TF gene. The liver is the main source of manufacturing transferrin, but other sources such as the brain also produce this molecule. Transferrin is a glycoprotein that binds iron very tightly but reversibly. Although iron bound to transferrin is less than 0.1% (4 mg) of the total body iron, it is the most important iron pool, with the highest rate of turnover (25 mg/24 h). Transferrin has a molecular weight of around 80 kiloDaltons and contains 2 specific high-affinity Fe(III) binding sites. The affinity of transferrin for Fe(III) is extremely high ($10^{23}M^{-1}$ at pH 7.4) but decreases progressively with decreasing pH below neutrality.When not bound to iron, it is known as "apo-transferrin".

Transferrin consists of a poly peptide chain containing 679 amino acids. It is a complex composed of alpha helices and beta sheets to form two domains (the first situated in the N-terminus and the second in the C-terminus). The N- and C- terminal sequences are represented by globular lobes and between the two lobes is an iron-binding site.

The amino acids which bind the iron ion to the transferrin are identical for both lobes; two tyrosines, one histidine , and one aspartic acid. In order for the iron ion to bind an anion is required, preferably carbonate (CO_3^{2-}).

Transferrin also has a transferrin iron-bound receptor; it is a disulfide-linked homodimer. In humans, each monomer consists of 760 amino acids. It enables ligand bonding to the transferrin, as each monomer can bind to one or two molecules of iron. Each monomer consists of three domains: the protease domain, the helical domain, and apical domain. The shape of transferrin receptor resembles a butterfly-like complex, due to the three clearly shaped domains[52].

Prealbumin is now known as Transthyretin (TTR), a serum and cerebrospinal fluid carrier of the thyroid hormone thyroxine (T4) and retinol. This is how transthyretin gained its name, **trans**ports **thy**roxine and **retin**ol. TTR was originally called prealbumin because it ran faster than albumins on electrophoresis gels.

It is a 55-kDa homotetramer with a dimer of dimers configuration that is synthesized in the liver, choroid plexus and retinal pigment epithelium. Each monomer is a 127-residue polypeptide rich in beta sheet structure. Association of two monomers forms an extended beta sandwich. Further association of another identical set of monomers produces

the homotetrameric structure. The two thyroxine binding sites per tetramer sit at the interface between the latter set of dimers[5].

In nutritional assessment pre albumin is preferred because of its shorter half life[5].

Combination of anthropometry and biochemical markers.

Creatinine – arm index (CAI)and creatinine – height index (CHI) are used to overcome the inaccuracy found in nutritional assessment by either of the method alone[53].

CHI is defined as the urinary creatinine excretion over a period of 24 hours expressed as a percentage of the value expected to be excreted in normal subjects of the same height and sex.

$$CAI = \frac{\text{actual daily urinary creatinine excretion}}{\text{expected daily urinary creatinine excretion}}$$

Expected creatinine excretion = IBW x creatinine coefficient

IBW(ideal body weight) = (2 x WC) + (1.25 x TAL) - 40.9

WC = Wrist circumference

TAL = Total arm length

Creatinine coefficient = creatinine concentration/IBW (age and sex corrected)

Nutritional Index of Rainey-Macdonald et al.

Rainey-Macdonald et al developed an index based on serum albumin and transferrin that can help identify patients who may benefit from nutritional support[54].

Nutritional index = (1.20 x (serum albumin in g/dL)) + (0.013 x (serum transferrin in mg/dL)) - 6.43

Anyone with an index < 0 qualified for nutritional support.

Nutritional assessment questionnaire

Mini Nutritional Assessment (MNA) and Subjective Global Assessment (SGA) are the two questionnaire based nutritional assessment tools. They both have been found to be simple, noninvasive and cost-effective tool for assessing nutritional status of the elderly[55-58] .

Other nutritional assessment methods.

DEXA measured water isotope dilution volumes and whole body counting / in vivo neutron activation analysis to estimate total body potassium are more accurate than anthropometry but time consuming , expensive and invasive[7].

Bio electric impedence analysis (BIA) is an inexpensive, quick, safe and non invasive technique to measure body composition. It measures tissue conductivity which is proportional to the amount of electrolyte rich fluid present. All body water and fluids are bound in the fat free body mass component. Using population specific equations , BIA can be used to estimate fat free body mass under standardized conditions[59,60].

Muscle function tests and lymphocyte mitochondrial function tests are the newer approaches in the nutritional assessment. The changes in the muscle and lymphocyte function in response to the changes in the nutrition occur quickly and before there are any changes in the body composition. They are independent of the inflammatory states too[61].

Wound related complications and nutrition.

The relation between wound related complications and the nutritional status of the patient has been extensively studied in surgical and orthopaedic patients. Increased incidence of wound complications in undernourished has been found uniformly in all the studies[62-67]. Nutritional supplementation was found to be effective in reducing wound related complications[68].

There are two types of wound infection possible in orthopaedic patients[69] –

1. Superficial infection
2. Deep infection

The superficial infection occurs within 30 days after the operation.It involves only the skin or subcutaneous tissue and at least 1 of the following:

1.Purulent drainage is present (culture documentation not required).

2.Organisms are isolated from fluid/tissue of the superficial incision.

3.At least 1 sign of inflammation (eg, pain or tenderness, induration, erythema, local warmth of the wound) is present.

4.The wound is deliberately opened by the surgeon.

5.The surgeon or attending physician declares the wound infected.

The deep infection occurs within 30 days of the operation or within 1 year if an implant is present. It Involves deep soft tissues (eg, fascia and/or muscle) of the incision and at least 1 of the following:

1.Purulent drainage is present from the deep incision but without organ/space involvement.

2.Fascial dehiscence or fascia is deliberately separated by the surgeon because of signs of inflammation.

3.A deep abscess is identified by direct examination or during reoperation, by histopathology, or by radiologic examination.

4.The surgeon or attending physician declares that a deep incisional infection is present.

. MATERIALS AND METHODS

This study is a **prospective descriptive** study done to determine the effect of major elective orthopaedic surgery on the nutritional status of the patients. The patients included in the study are those who got admitted and operated under Orthopaedics unit 1 and Spinal Disorder Surgery unit , Christian Medical College, Vellore from February 2007 to April 2008 and March 2009 to September 2009.

Inclusion criteria

All patients undergoing major elective orthopaedic surgery under orthopaedic unit 1 and Spinal Disorder Surgery unit. Major orthopaedic surgery includes spine instrumentation surgeries and joint replacement surgeries[70,71].

Exclusion criteria

1.Trauma patients.

2.Patients admitted for tumour surgeries.

Sample size

Sample size for a descriptive prospective study = $\frac{Z\alpha^2 \times PQ}{d^2}$

Zα = 1.96 for p value 0f 0.005

d = precision which is taken as 7

P = 40 .According to literature around 40 % of orthopaedic inpatients are malnourished[37-41].

Q = 100-P = 60

Therefore calculated sample size is approximately **200**.

Nutritional assessment

The nutritional assessment was done by both anthropometry (BMI) and biochemical markers(Prealbumin and Transferrin). Since MUAC and TSF were found to be highly observer dependant and inaccurate, they were not used for analysis. Similarly since prealbumin and transferrin were better predictors of the nutritional status ,other biochemical markers(albumin and total lymphocyte count) were not analysed.

The patients were evaluated pre op, post op (at suture removal) and at three months follow up. The Proforma was filled up for each patient which included demographic details, diagnosis, surgery done , comorbidities and the nutritional parameters.

Urinary Tract Infection (UTI) referred to in our study is defined as the bacterial infection of any part of the urinary tract (urethra, bladder or kidney) confirmed with urine culture.Females are more at risk for UTI due to the anatomical differences.Paraplegics are also more at risk for UTI. In symptomatic patients , the diagnostic criteria are -

1.Women: Presence of at least 100,000 colony- forming units (cfu)/mL in a pure culture of voided clean-catch urine.

2.Men: Presence of just 1,000 cfu/mL indicates urinary tract infection.

In asymptomatic patients the diagnostic criteria are -

1. Women :2 consecutive voided urine samples with isolation of same strain in >100,000 cfu/mL.

2.Men: single, clean-catch specimen with bacterial species isolated in $\geq$ 100,000 cfu/mL .

3.Single catheterized urine specimen in both men and women with 1 bacterial species isolated in a count of $\geq$ 1,000 cfu/mL.

The wound related complications in our study are described as either superficial wound infection or deep wound infection. Superficial wound infection is defined as the wound infection in which infection has not breached the deep fascia and when no surgical intervention is needed for the control of infection. It responds to dressings and antibiotic therapy. Deep

infection is defined as the wound infection in which the infection has breached the deep fascia and when surgical intervention (wash out and drainage) along with antibiotic therapy is needed for the control of infection.

We have divided our patients in to two age groups for comparison - age more than 40 yrs and less than 40 yrs. In western literature , age cut off for elderly age group is taken as 60 yrs[15 - 24]. We have taken 40 yrs as cut off taking in to consideration the physiological differences between our population and the western population.

The statistical analysis was done using SPSS software version 16.The statistical tests used were Chi square test and repeated variable Annova test.

RESULTS

Patient demographics

Total number of patients assessed during the above mentioned time period was 199. Total number of cases followed up was 113 (56.78% follow up).

Surgery done	Patients seen	Patients followed up
Spine surgeries	**92**	**51**
1.PLIF	64	33
2.Infective Spondylitis	28	18
Unilateral replacement	**76**	**46**
3.THR Unilateral	50	31
4.TKR Unilateral	26	15
Bilateral replacement	**31**	**16**
5.TKR Bilateral	20	11
6.THR Bilateral	8	4
7.Hip + Knee replacement	3	1
Total	**199**	**113**

The analysis was done on the 113 patients evaluated at the three months follow up.

Age – 16 to 76 yrs.

Average age – 48.8 yrs.

Median age - 49.5 yrs

Males – 59 pts. (52.2 %)

Females – 54 pts. (47.8 %)

Age > 40 yrs – 86 pts. (76.1%)

Comorbidities

Diabetes – 21 pts. (18.6%)

Hypertension –19 pts, (16.8%)

The bilateral THR and hip + knee replacement groups were not analyzed separately because of the small number of patients followed up. They are included in the analysis under bilateral replacement group.

The number of patients with BMI less than 20(Undernourished) was only 5 (4.42 %). Prealbumin was less than 20 in 4 out of these 5 patients. There was no patient with transferrin value less than 200.

The number of patients with BM I more than 25 (overweight) was 38 (33.62 %).Prealbumin and transferrin values has been analyzed separately for the different surgical groups.

Complications

15 patients had wound related complications (13.3 %) – 11 superficial infection and 4 deep infection.

10 patients had urinary tract infection post op (8.8 %).

PLIF (posterior lumbar interbody fusion)

The number of patients followed up – 33

Age	– 23 to 75 yrs.
Average age	– 50.3 yrs.
> 40 yrs age group	– 29 pts. (87.9%)
Females	– 19 pts. (57.6%)
Males	– 14 pts. (42.4%)

Comorbidities

DM –8 pts. (24.2 %)

HT – 4 pts.(12.1 %)

BMI

BMI < 20 – 2 pts. (7.1 %)

BMI > 25 - 13 pts.(38.4 %)

There was no association of BMI with the incidence of wound infection. (Annexure - tables 91,92).

Analysis of prealbumin in PLIF group

The pre albumin values at pre op , post op and follow up of the PLIF patients shows a significant difference between all three values (p value 0.000).

There was significant difference in the pattern of values in diabetics (p value 0.001) and when comparing the age groups (p value 0.004).

Patients with wound infection showed significant difference in the pattern of values but was not statistically significant (p value 0.077).

HT and gender did not reveal any significant difference in the pattern of values.

Analysis of transferrin in PLIF group

The transferrin values at pre op , post op and follow up of the PLIF patients shows a significant difference between all three values (p value 0.000).

There was significant difference in the pattern of values in diabetics (p value 0.000), when comparing between the age groups (p value 0.012) and in patients with wound infection (p value – 0.033).

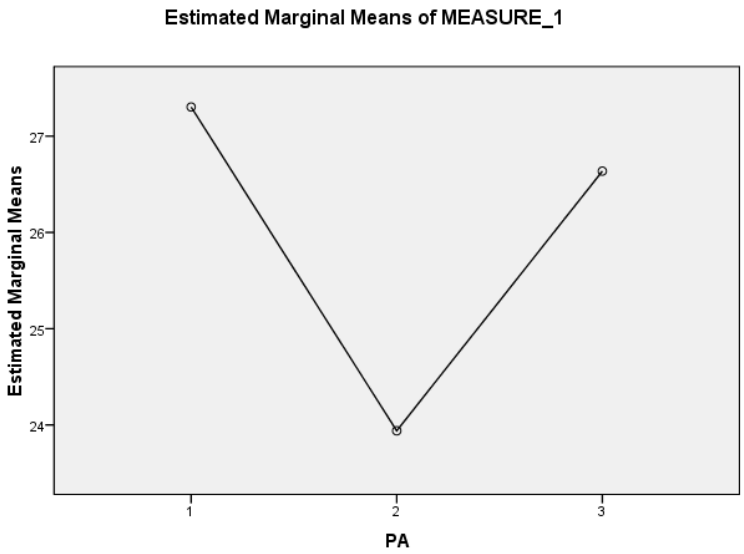
HT and gender did not reveal any significant difference in the pattern of values.

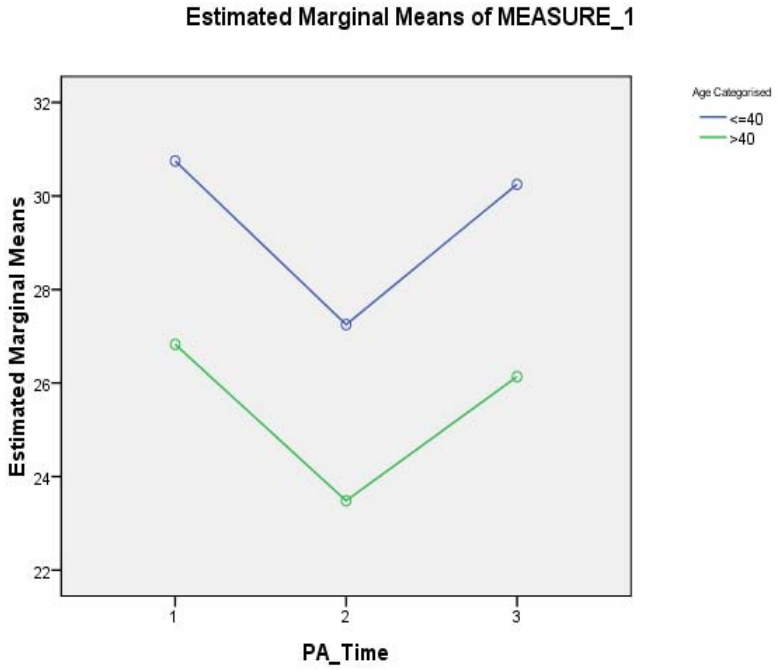
Complications

Wound infection – 3 pts. (9.1 %).

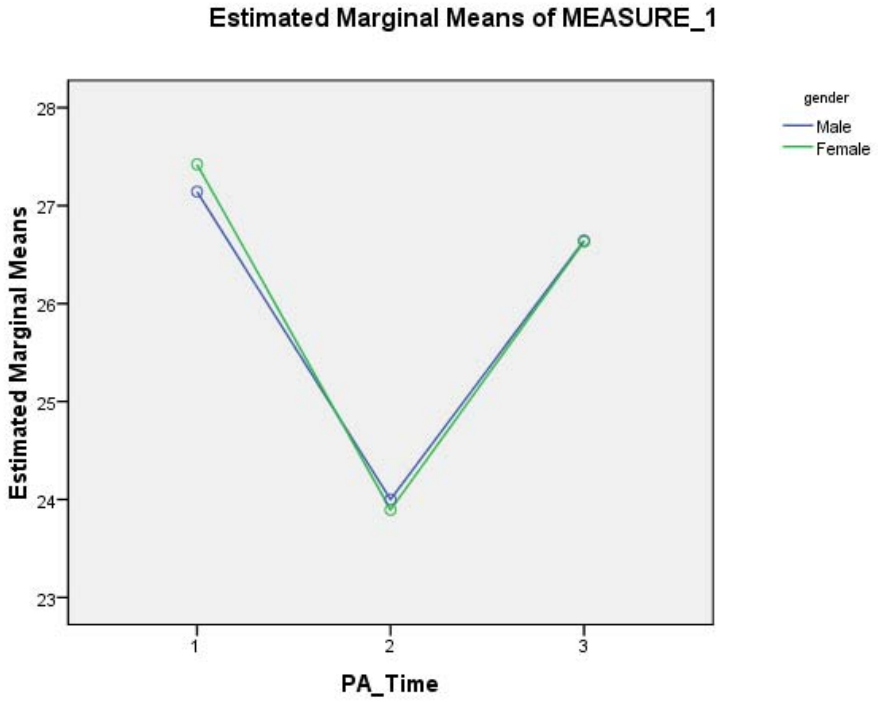
2 were deep infection and 1 superficial infection.

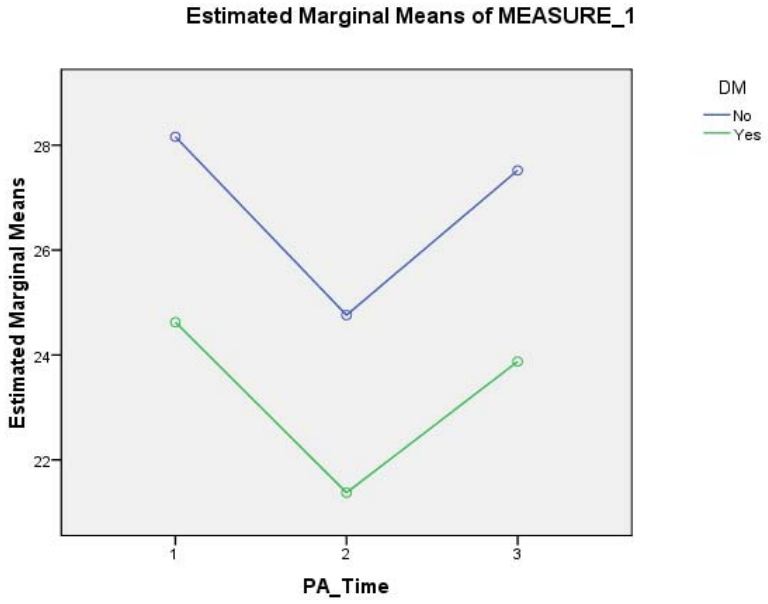
Graphs for analysis of prealbumin in PLIF group (Tables 1,2)



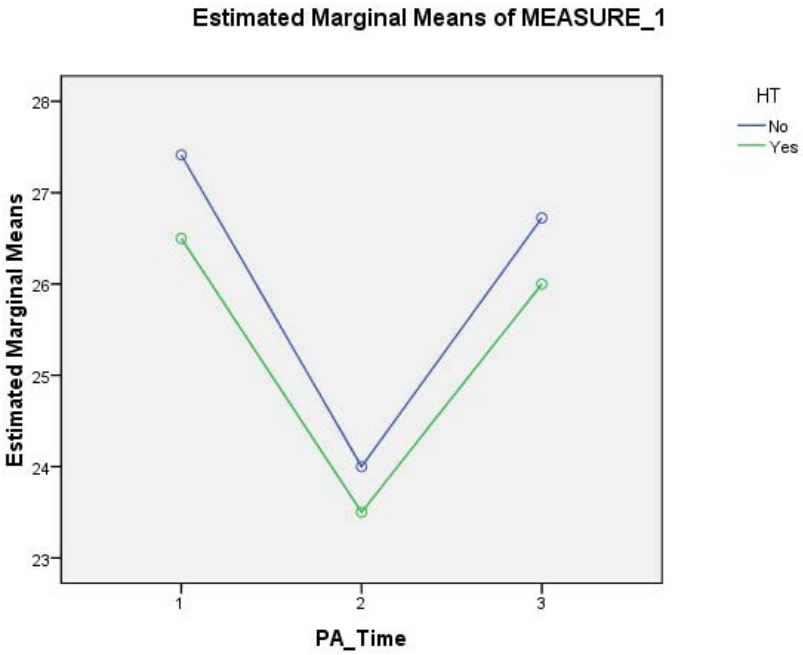


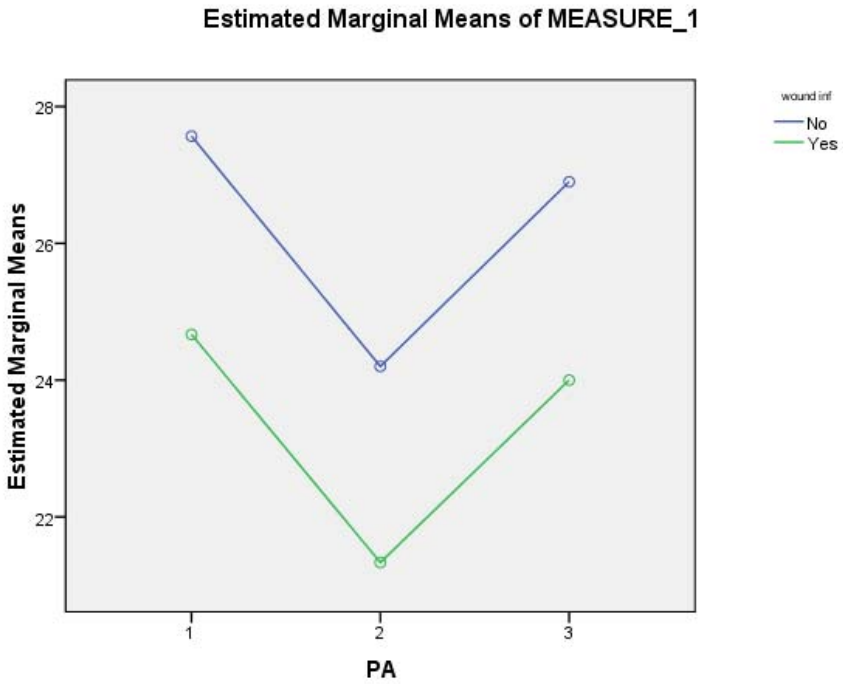
Graphs for analysis of prealbumin in PLIF group(Tables 3,4)



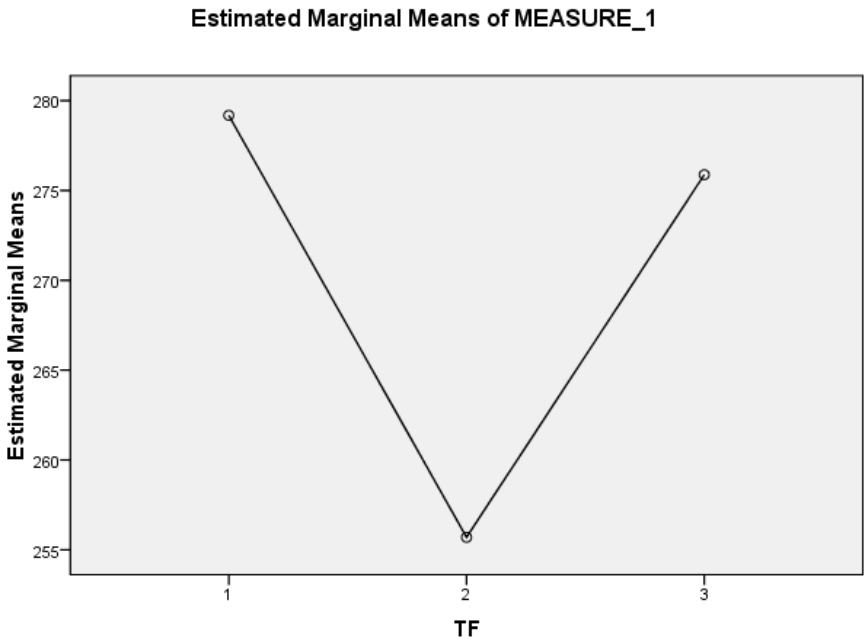


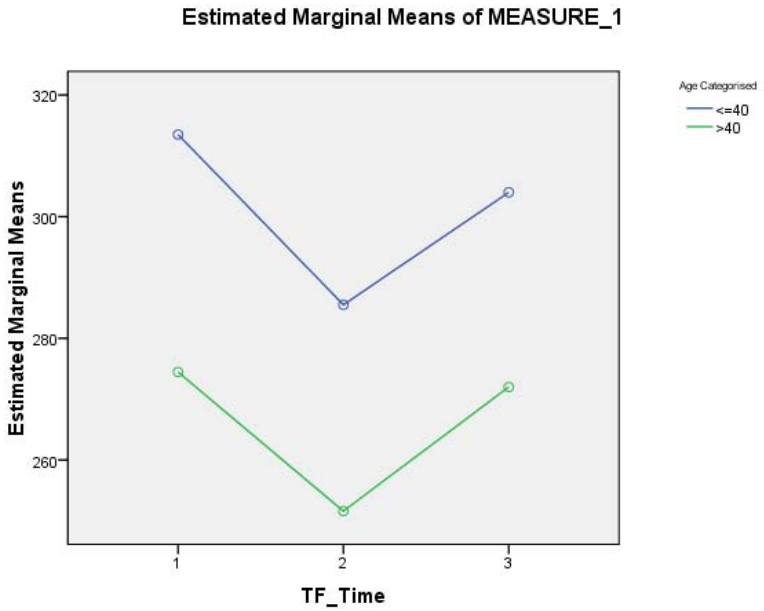
Graphs for analysis of prealbumin in PLIF group(Tables 5,6)



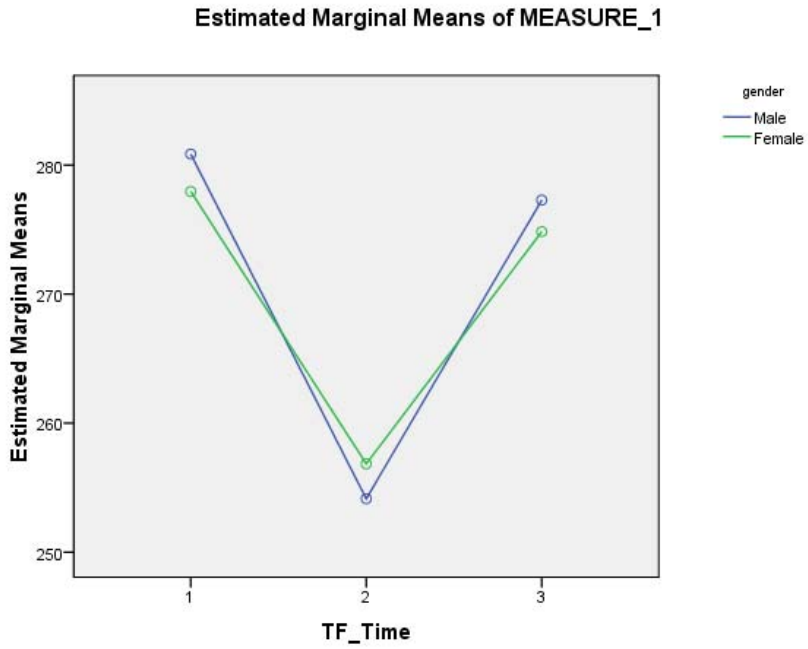


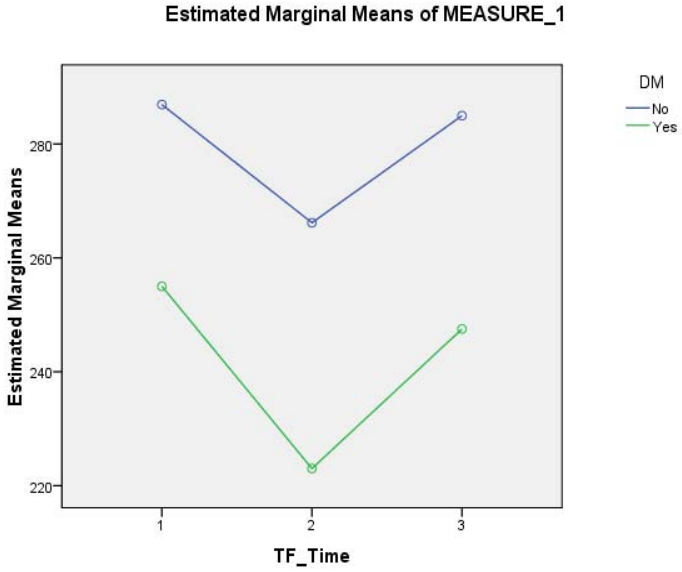
Graphs for analysis of transferrin in PLIF group(Tables 7,8)



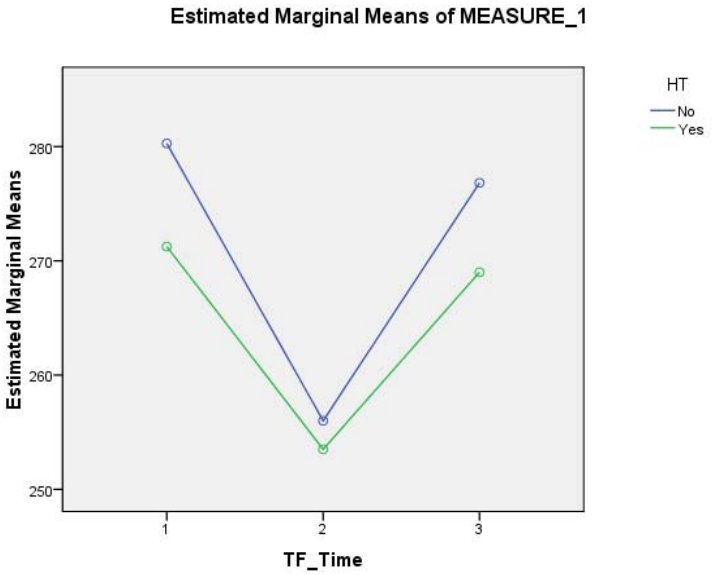


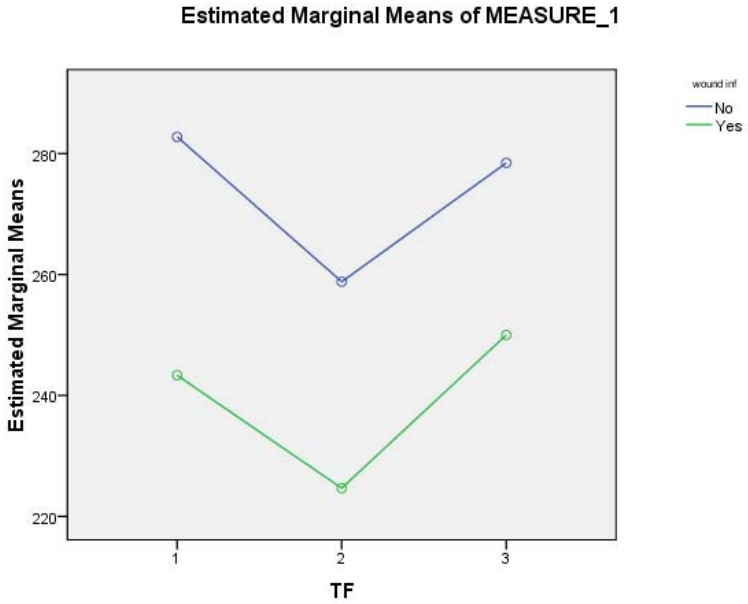
Graphs for analysis of transferrin in PLIF group(Tables 9.10)





Graphs for analysis of transferrin in PLIF group(Tables 11,12)





Infective Spondylitis

The number of patients followed up - 18

Age – 16 to 72 yrs.

Average age – 40.55 yrs.

< 40 yrs age group – 11 pts. (61.1%)

Females – 5 pts.(27.8%)

Males – 13 pts.(72.2%)

The Number of paraplegics – 10 pts.(55.56%)

Comorbidities

DM – 4 pts. (22.2 %)

HT – 3pts. (16.7 %)

BMI

BMI < 20 – 2 pts. (11.1 %)

BMI > 25 – 2 pts. (11.1%)

There was no association of BMI with the incidence of UTI and wound infection.(Annexure – tables 93 to 96).

Analysis of prealbumin in Infective Spondylitis group

The prealbumin values at pre op , post op and follow up of the infective spondylitis patients shows a significant difference between all three values (p value 0.000).

No statistically significant difference was observed in the pattern of prealbumin values between the variables for comparison (age group, gender, DM, HT).

Patients with wound infection showed significant difference in the pattern of values but was not statistically significant (p value 0.147).

Analysis of transferrin in Infective Spondylitis group

The transferrin values at pre op , post op and follow up of the infective spondylitis patients shows a significant difference between all three values (p value 0.000).

No statistically significant difference was observed in the pattern of transferrin values between the variables for comparison (age group, gender, DM, HT).

Complications

Wound infection – 2 pts. (11.1 %)

Both were superficial infection.

UTI –8 pts.(44.4 %)

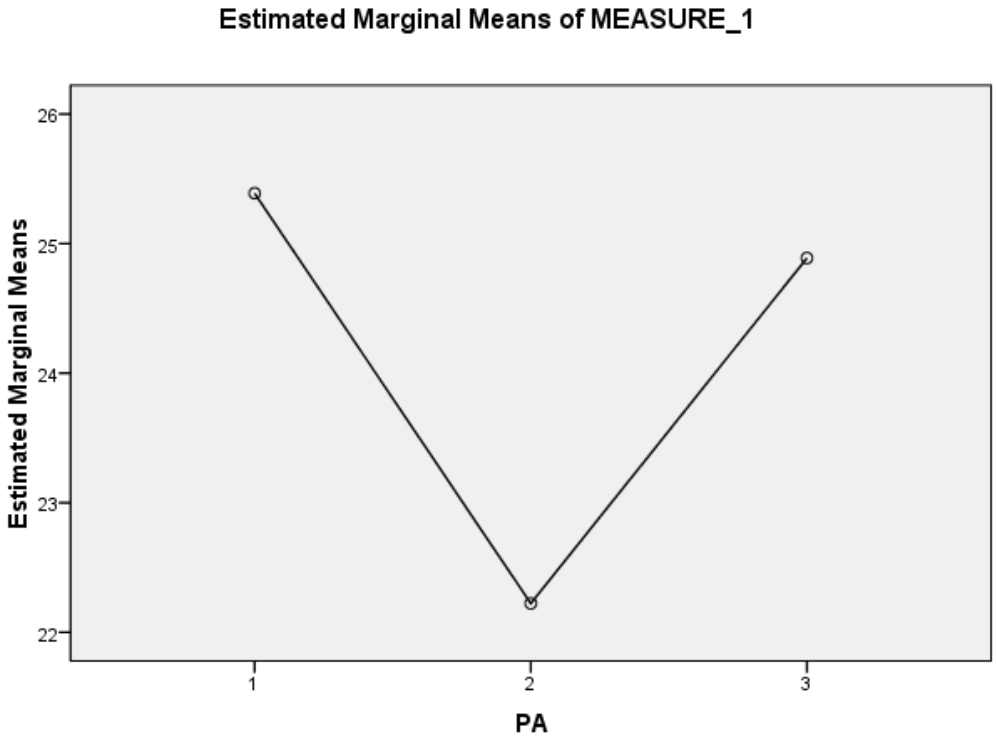
All the patients with UTI were on CBD.6 out of 8patients with UTI were paraplegic (75%).

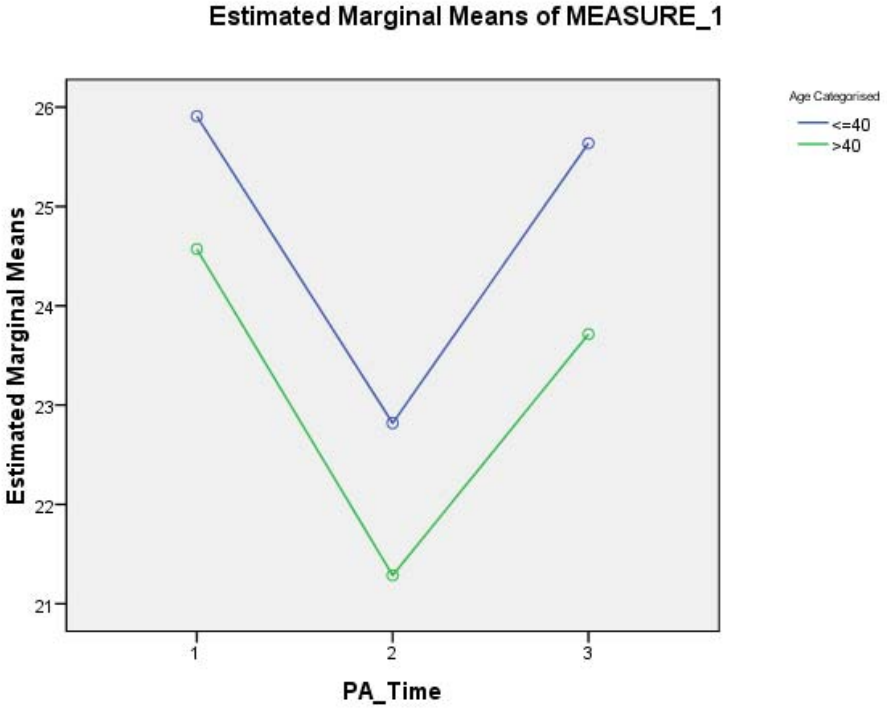
6 out of 10 paraplegics had UTI – 60 %.

Comparison beween PLIF group and Infective Spondylitis group

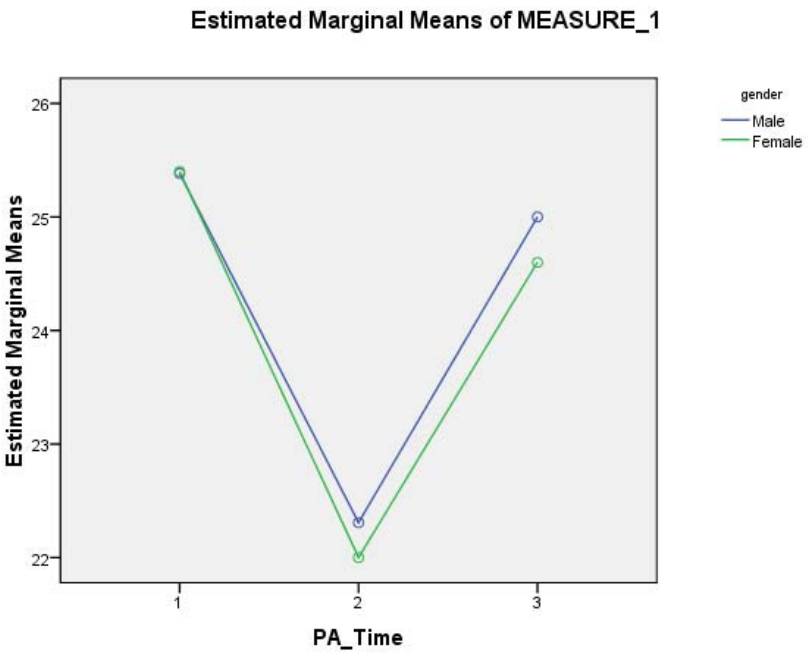
The pattern of prealbumin values showed a significant difference (p value 0.032) between the two groups. The pattern of transferrin values showed a difference which was not statistically significant(p value 0.2).

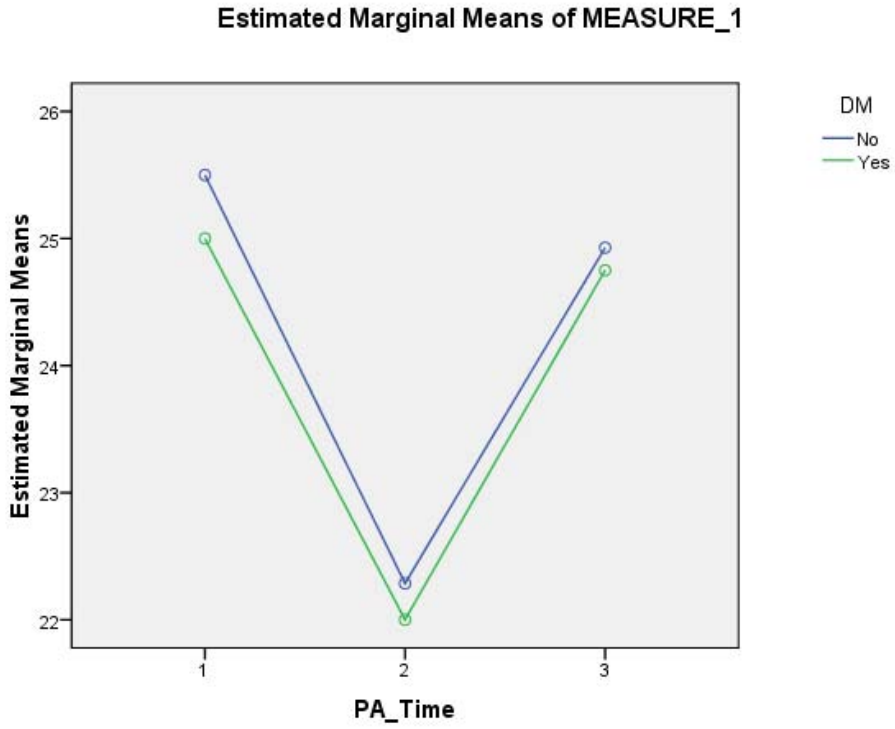
Graphs for analysis of prealbumin in Inf. Spond (Tables 13,14)



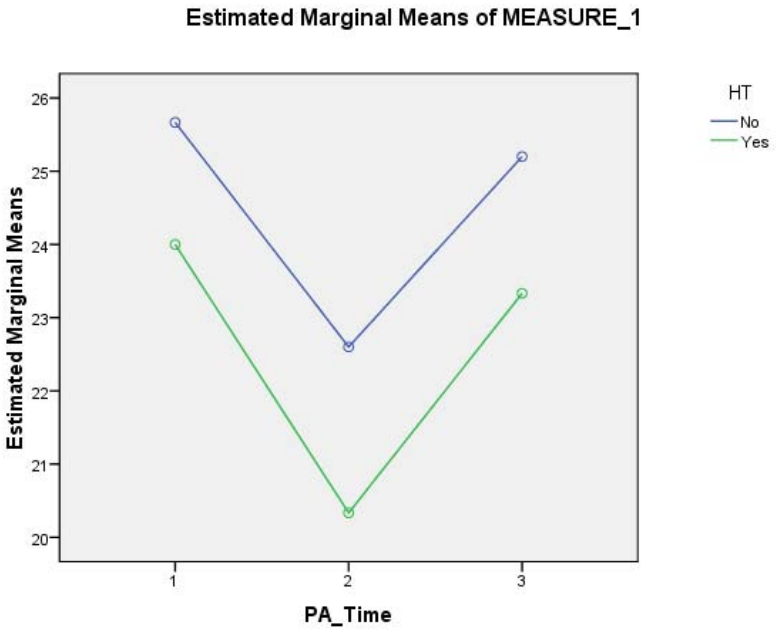


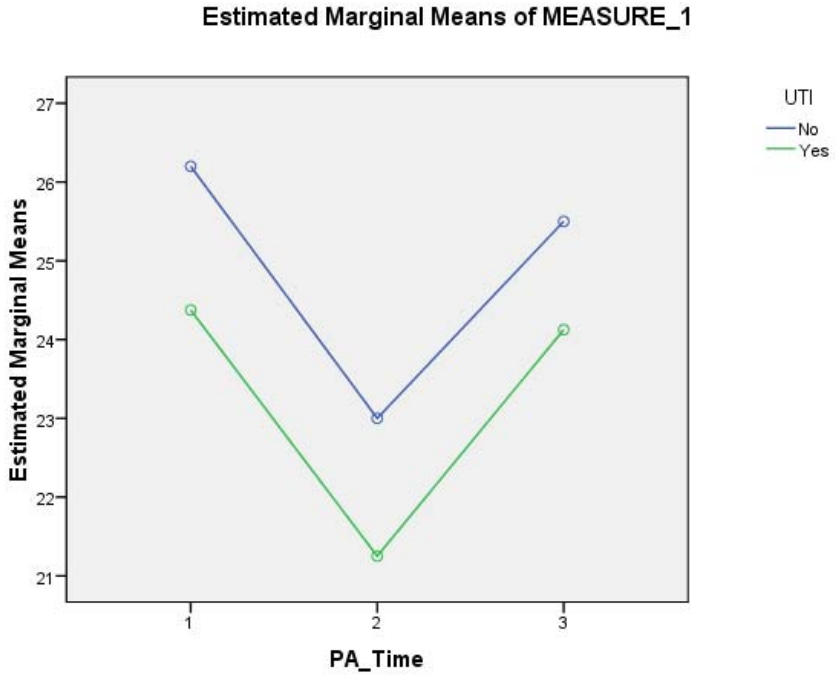
Graphs for analysis of prealbumin in Inf. Spond (Tables 15,16)



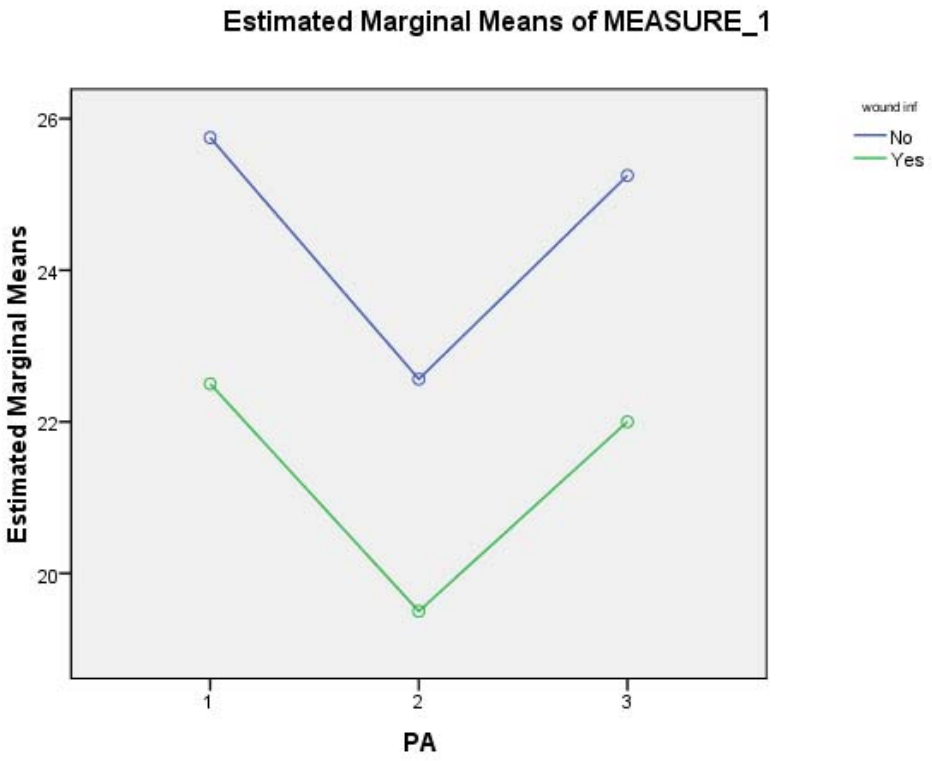


Graphs for analysis of prealbumin in Inf. Spond (Tables 17,18)

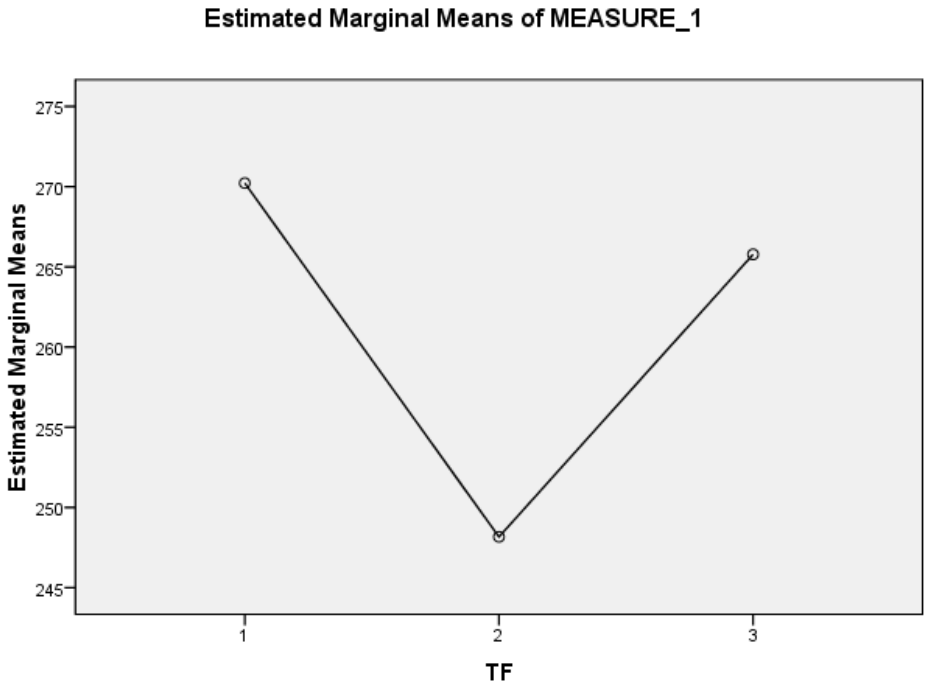


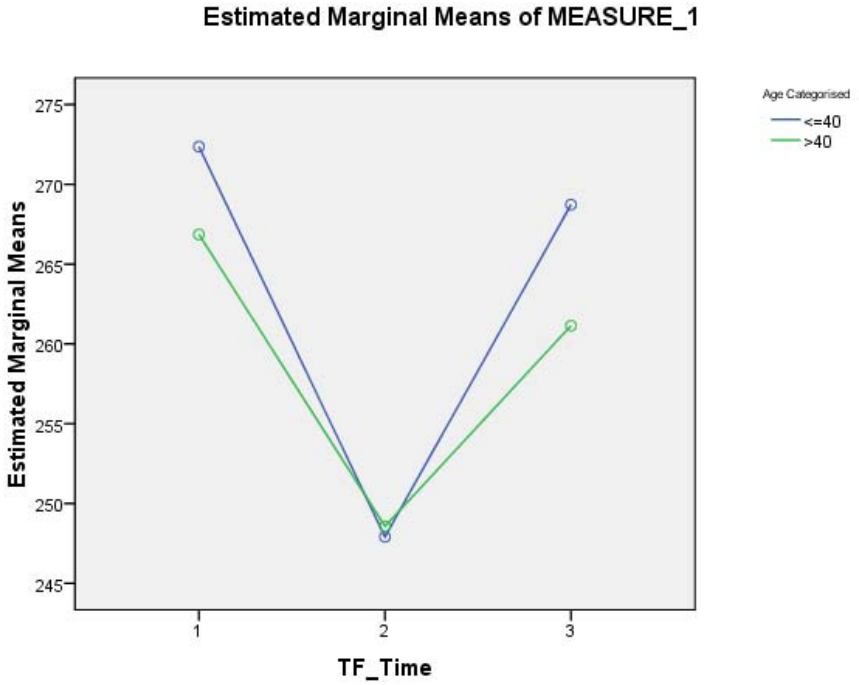


Graphs for analysis of prealbumin in Inf. Spond (Table 19)

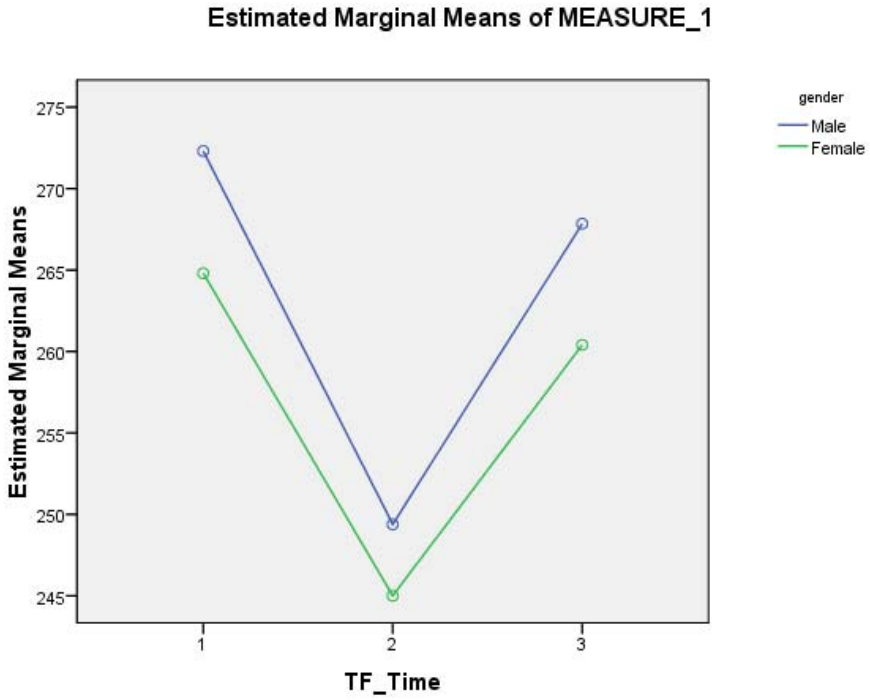


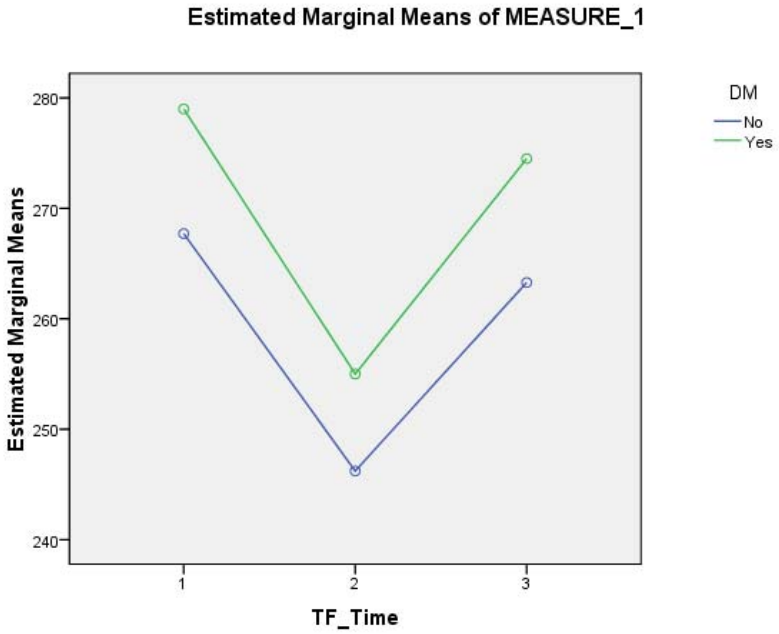
Graphs for analysis of transferrin in Inf. Spond (Tables 20,21)



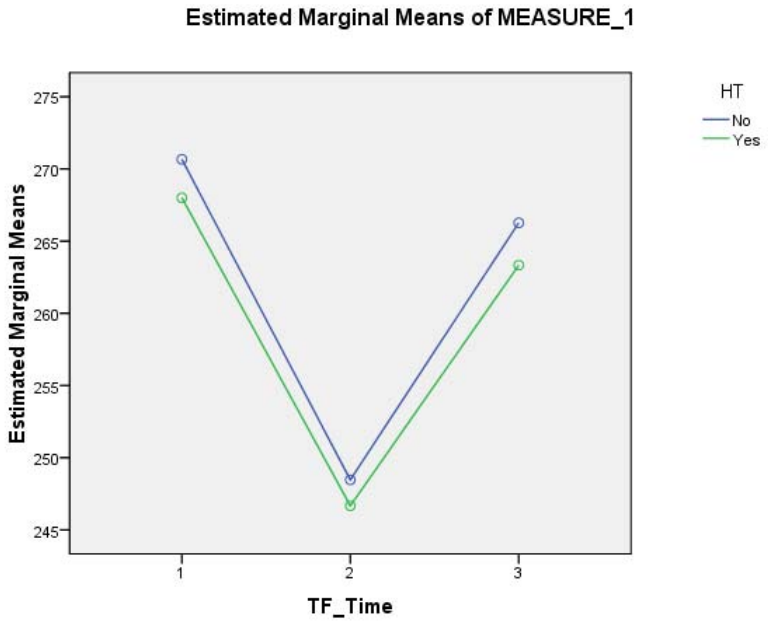


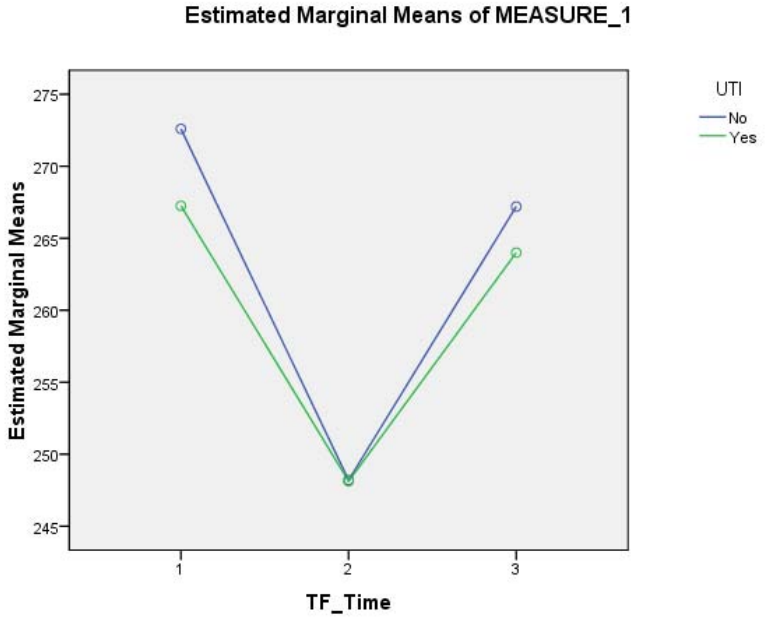
Graphs for analysis of transferrin in Inf. Spond (Tables 22,23)



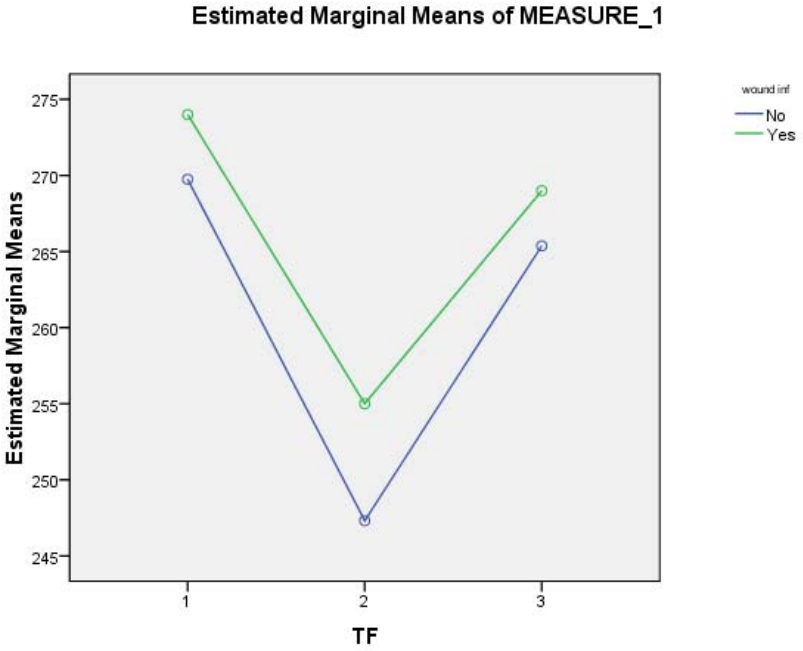


Graphs for analysis of transferrin in Inf. Spond (Tables 24,25)

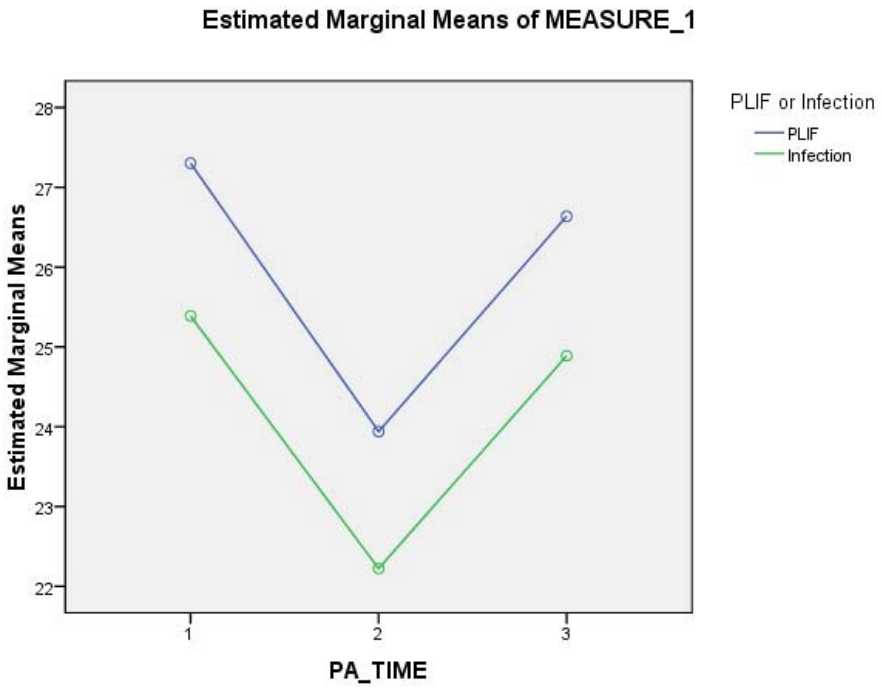


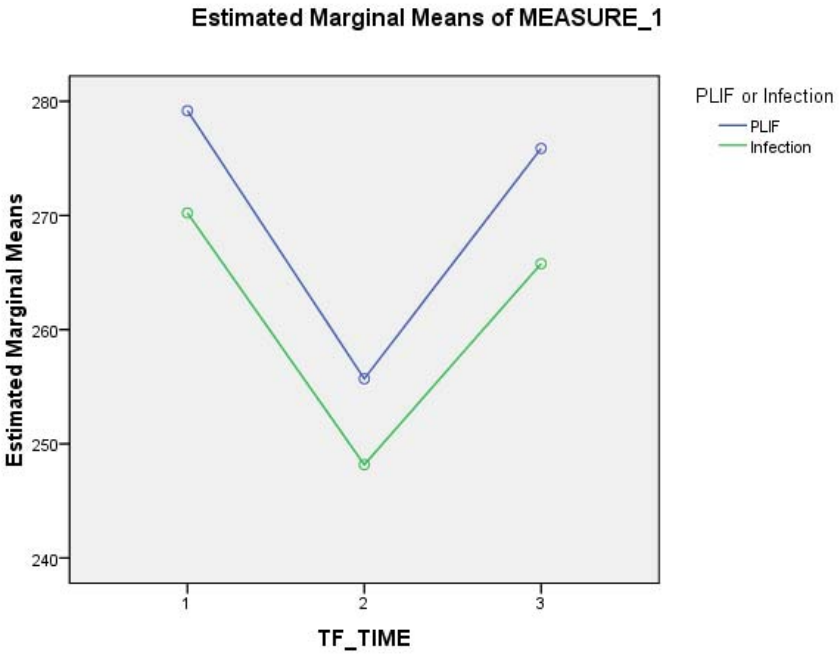


Graphs for analysis of transferrin in Inf. Spond (Table 26)



Graphs for comparison between PLIF group and Infective Spondylitis group (Tables 27,28)





Unilateral replacement

The number of patients followed up – 46.

Age – 21 to 76 yrs.

Average age – 49.30 yrs.

Age > 40 yrs – 36 pts.(78.3 %)

Males -21 pts.(45.7%)

Females – 25 pts.(54.3%)

Comorbidities

DM – 6 pts.(13 %)

HT – 8 pts.(17.4%)

BMI

BMI < 20 – 1pts. (2.1 %)

BMI > 25 – 18 pts. (39.13 %)

There was no association of BMI with the incidence of UTI and wound infection.

Analysis of prealbumin in Unilateral Replacement group

The prealbumin values at pre op , post op and follow up of the unilateral replacement patients shows a significant difference between all three values (p value 0.000).

No statistically significant difference was observed in the pattern of prealbumin values between the variables for comparison (gender, DM, HT) except when comparing age groups (p value 0.000).

Analysis of transferrin in Unilateral Replacement group

The transferrin values at pre op , post op and follow up of the unilateral replacement patients shows a significant difference between all three values (p value 0.000).

No statistically significant difference was observed in the pattern of transferrin values between the variables for comparison (gender, DM, HT) except when comparing age groups (p value 0.000).

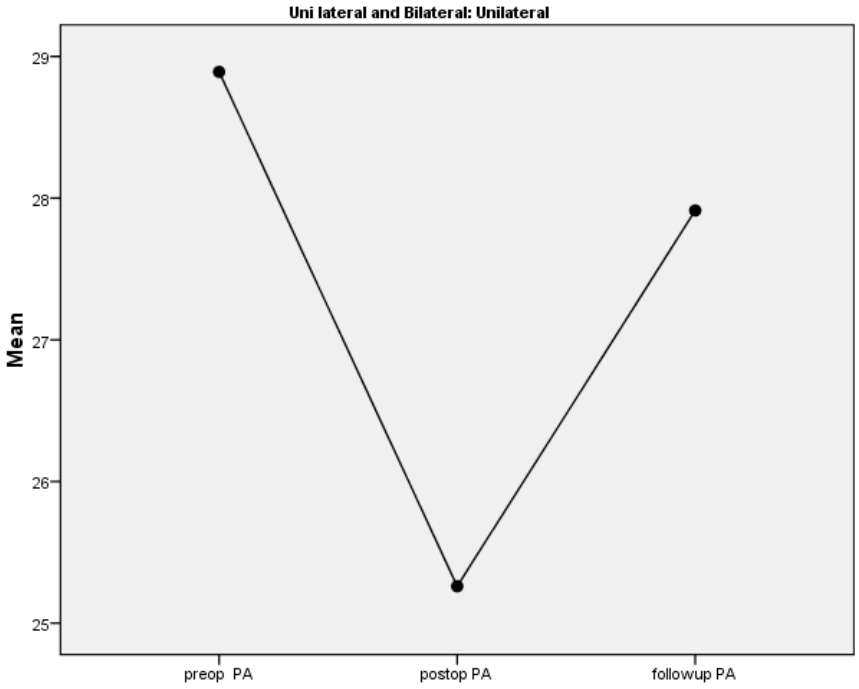
Complications

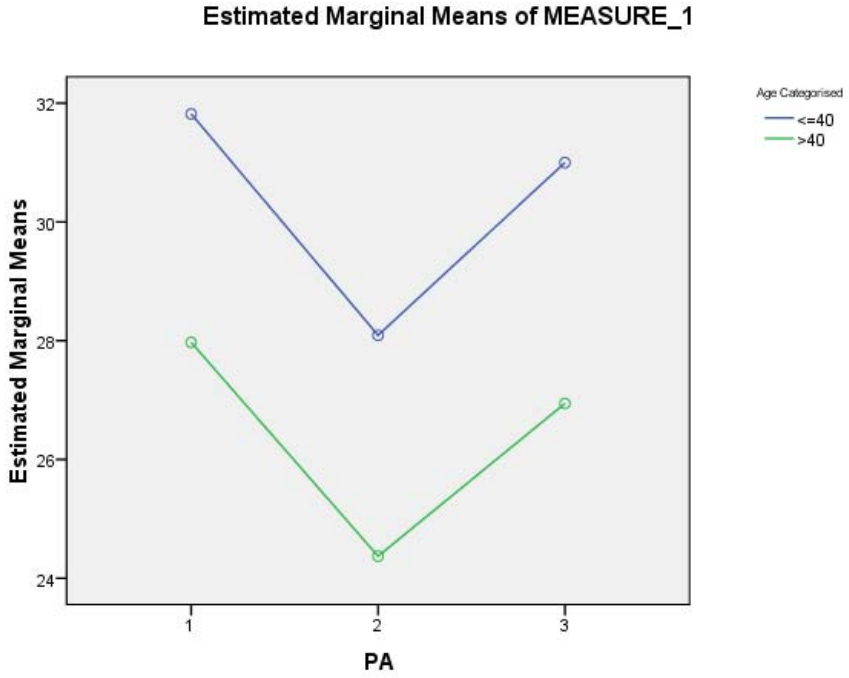
Wound infection – 8 pts (17.4%).

6 ot them were superficial infection (13%) and 2 were deep infection(4.4%).

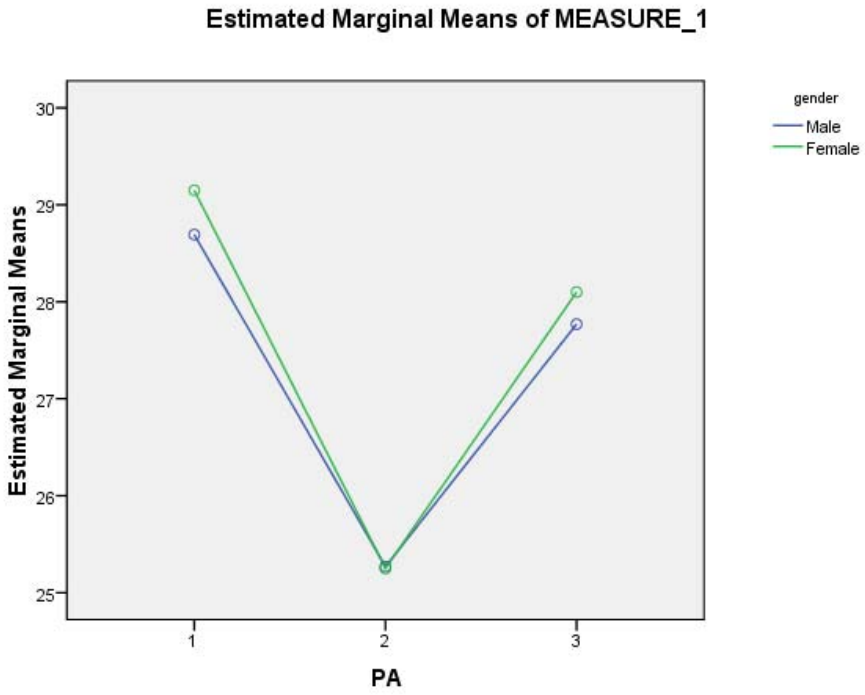
UTI – 1pt (2.1%) ; it was catheter related UTI.

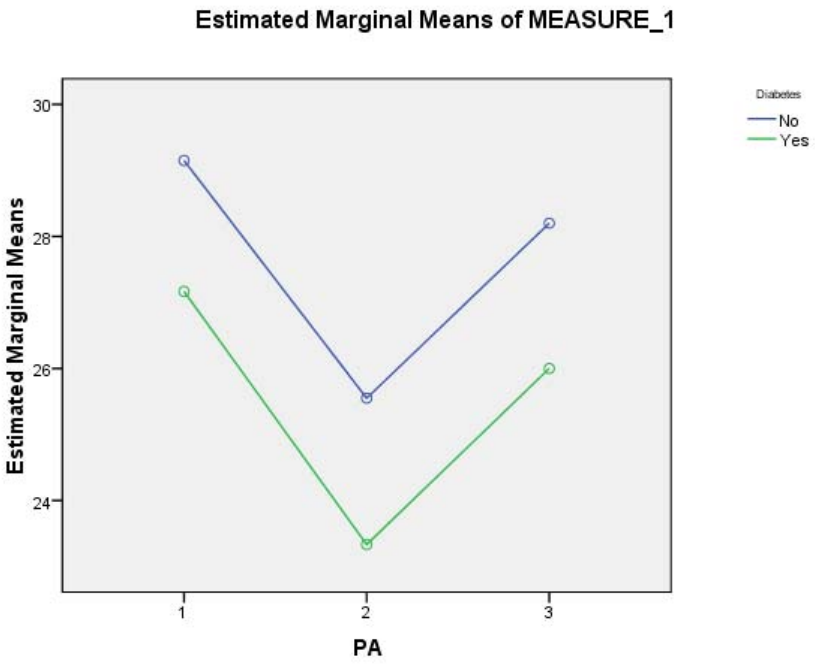
Graphs for analysis of prealbumin in Unilat replacement(Table 29)



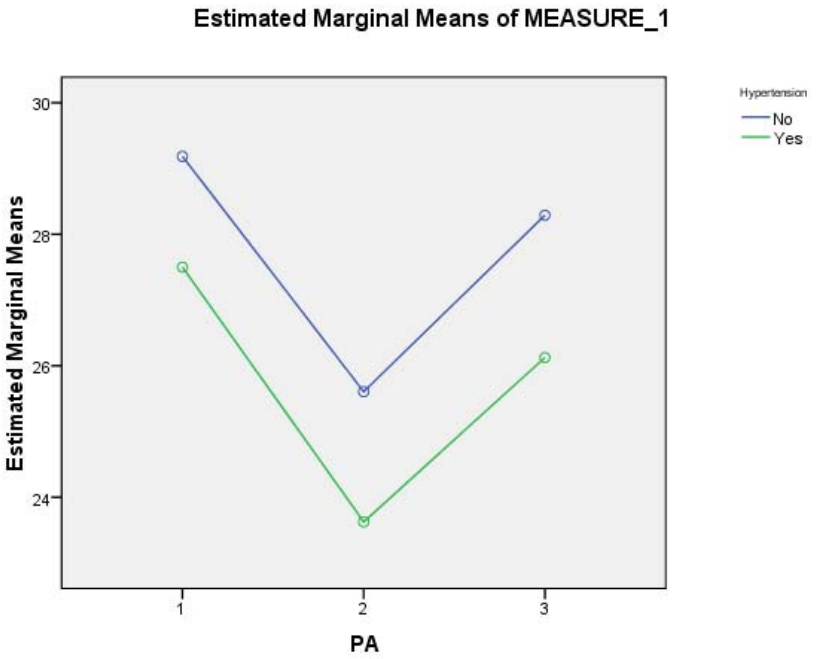


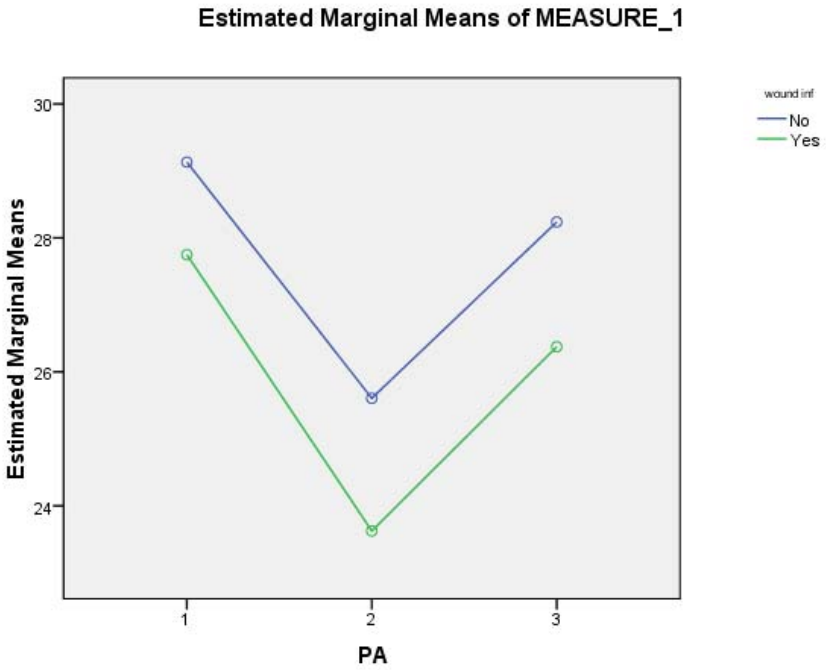
Graphs for analysis of prealbumin in Unilat replacement(Tables 30,31)



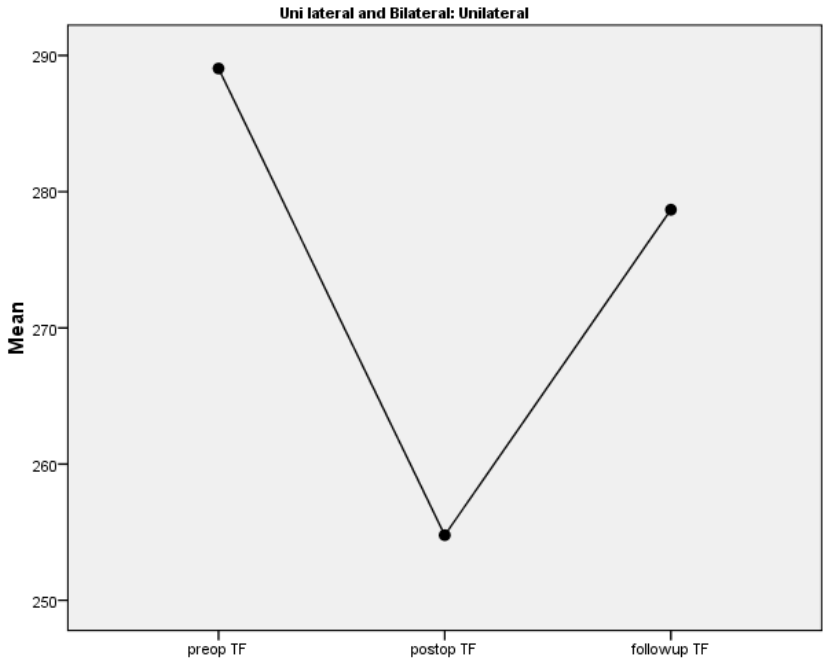


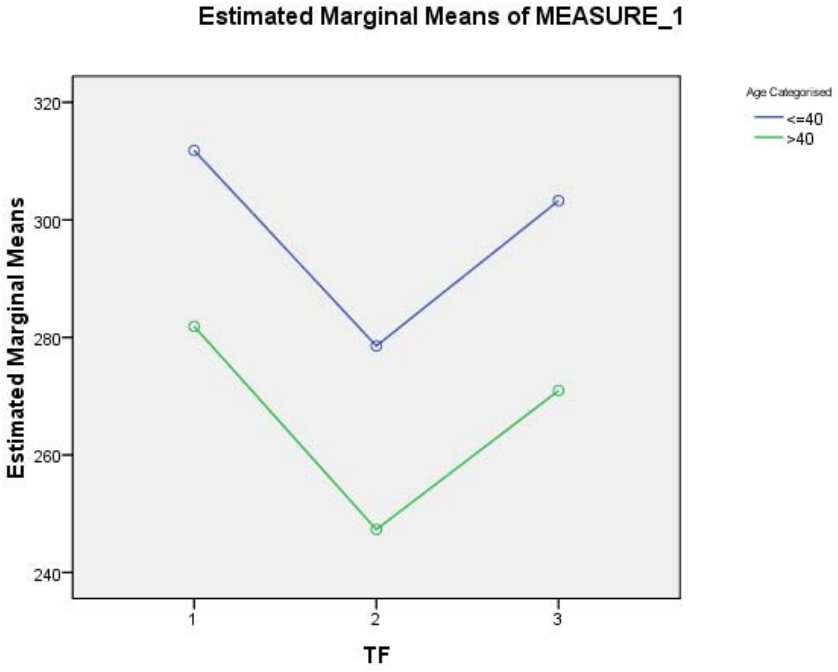
Graphs for analysis of prealbumin in Unilat replacement(Tables 32,33)



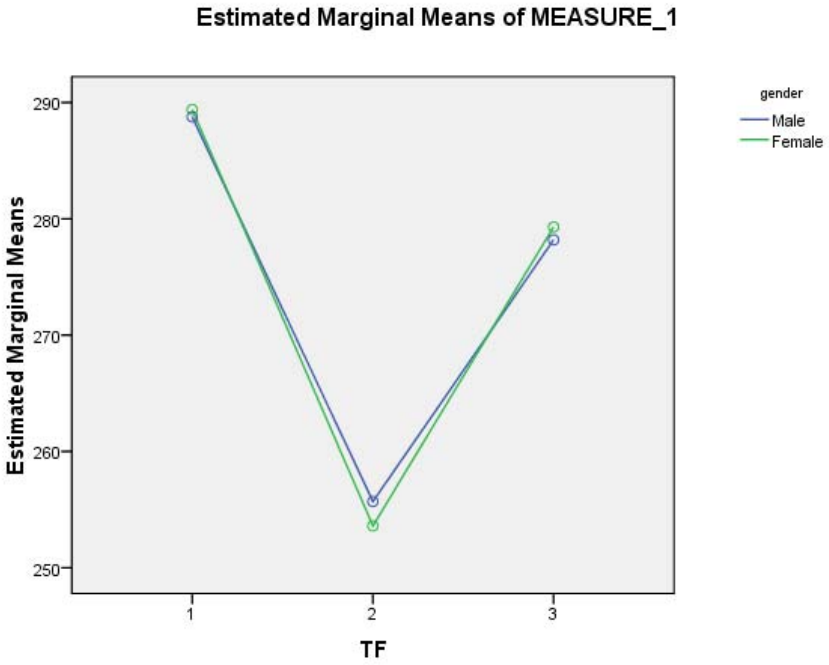


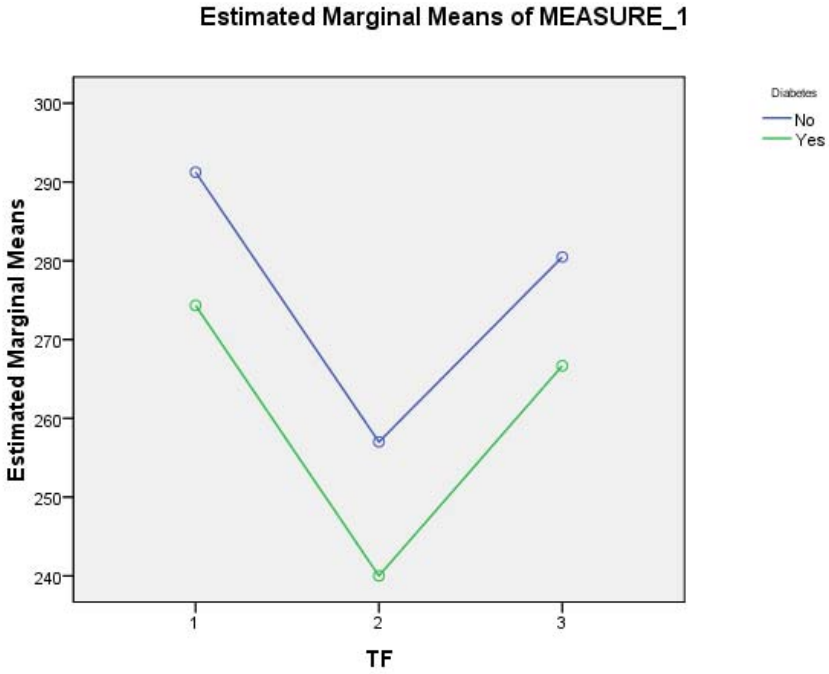
Graphs for analysis of transferrin in Unilat replacement(Table 34)



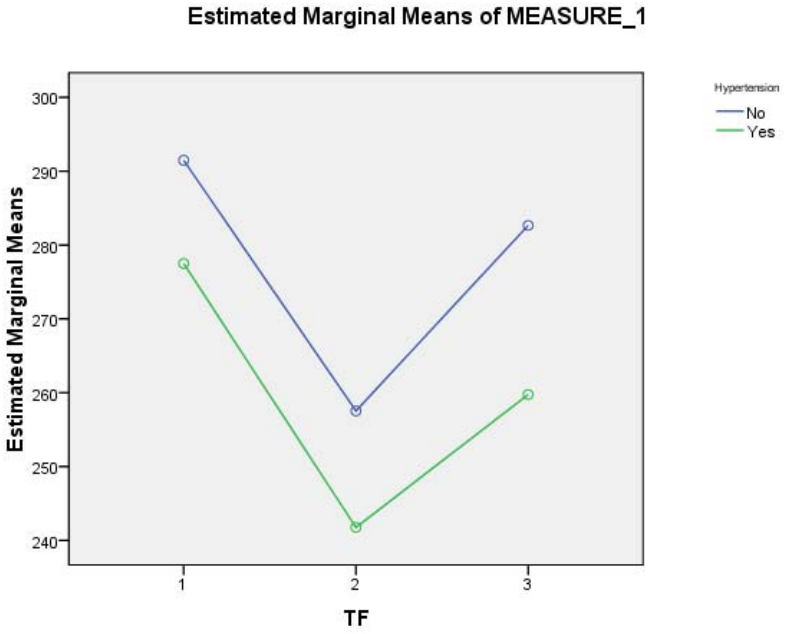


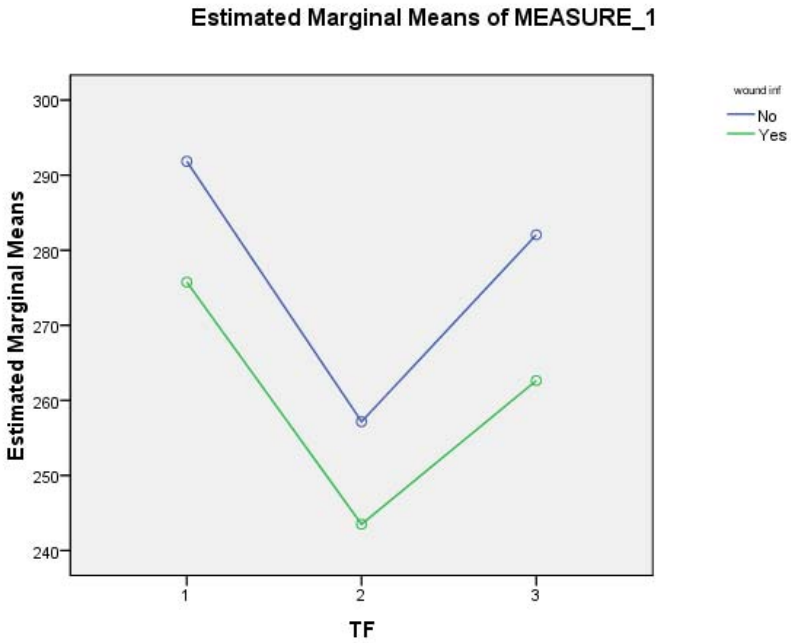
Graphs for analysis of transferrin in Unilat replacement(Tables 35,36)





Graphs for analysis of transferrin in Unilat replacement(Tables 37,38)





Bilateral Replacement

The Number of patients followed up – 16.

Age – 30 to 72 yrs.

Avg age – 53.5 yrs.

Age > 40 yrs – 15 pts.(93.75 %)

Males – 6 pts.(37.5%)

Females – 10 pts.(62.5 %)

Comorbidities

DM- 3pts. (18.75 %)

HT - 4 pts. (25%)

BMI

BMI < 20 – nil.

BMI > 25 – 5pts. (31.25%)

There was no association of BMI with the incidence of UTI and wound infection.

Analysis of prealbumin in Bilateral replacement group

The prealbumin values at pre op , post op and follow up of the bilateral replacement patients shows a significant difference between all three values (p value 0.000).

No statistically significant difference was observed in the pattern of prealbumin values between the variables for comparison(age group, gender, HT)except in diabetics (p value 0.006).

Analysis of transferrin in Bilateral replacement group

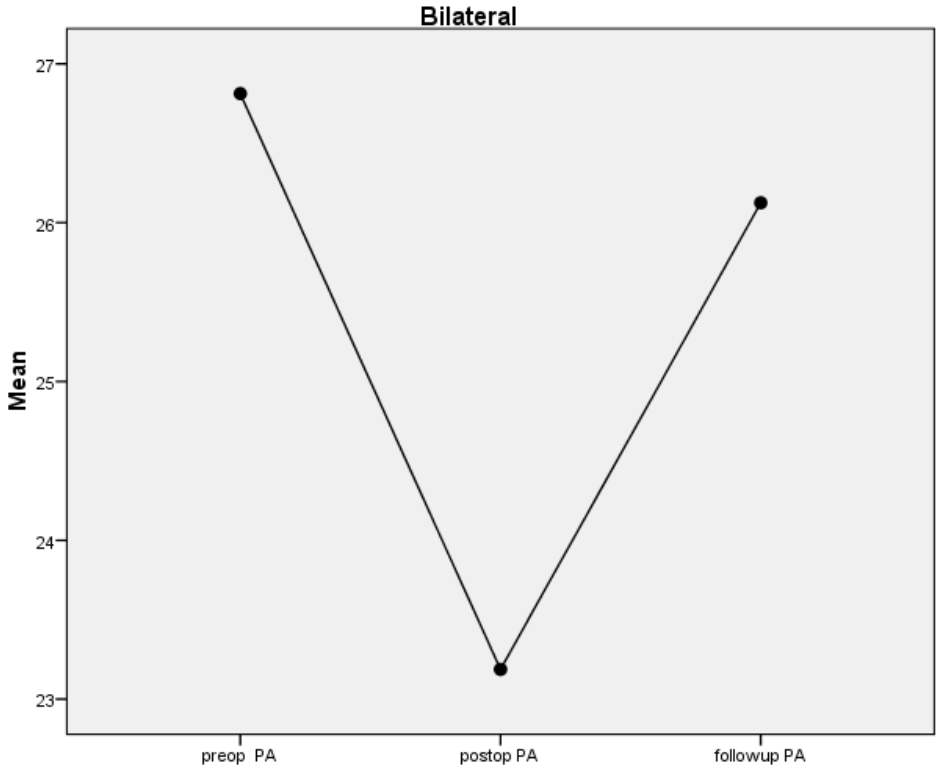
The transferrin values at pre op , post op and follow up of the bilateral replacement patients shows a significant difference between all three values (p value 0.000).

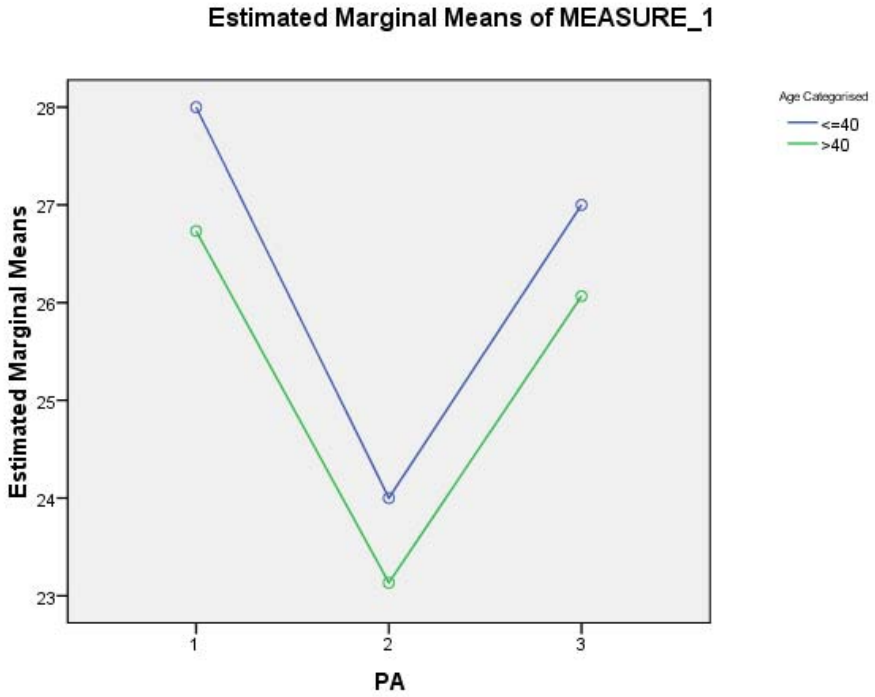
No statistically significant difference was observed in the pattern of transferrin values between the variables for comparison (age group, gender, DM, HT).

Comparison between Unilateral and Bilateral replacement groups

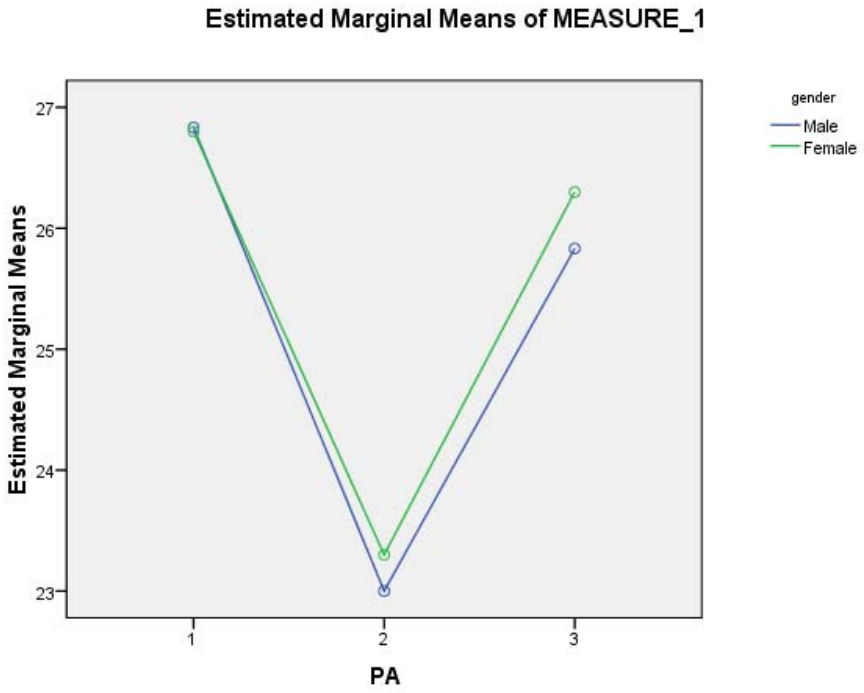
Pre albumin values showed a significant difference (p value 0.016) between the two groups .Transferrin values showed a difference which was not statistically significant (p value 0.077)

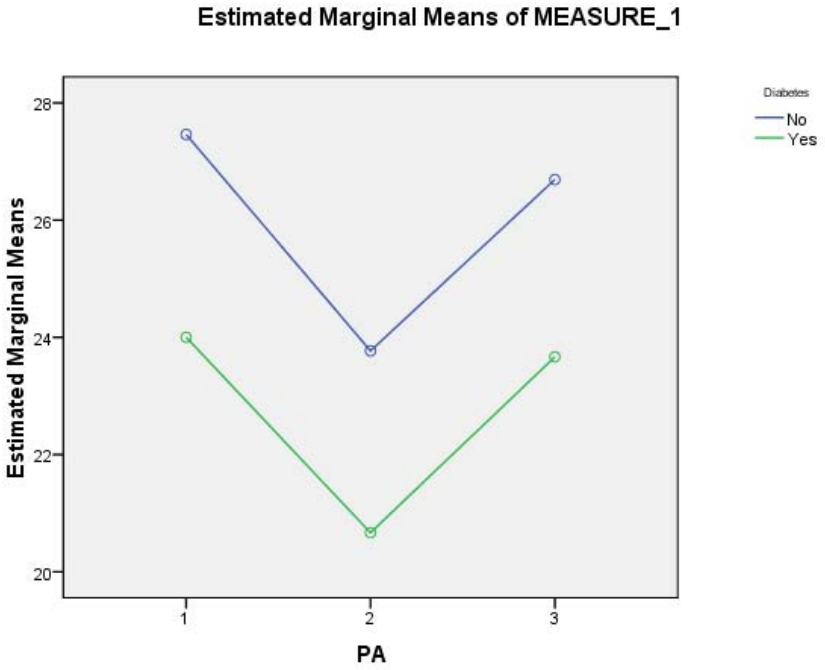
Graphs for analysis of prealbumin in Bilat replacement (Table 39)



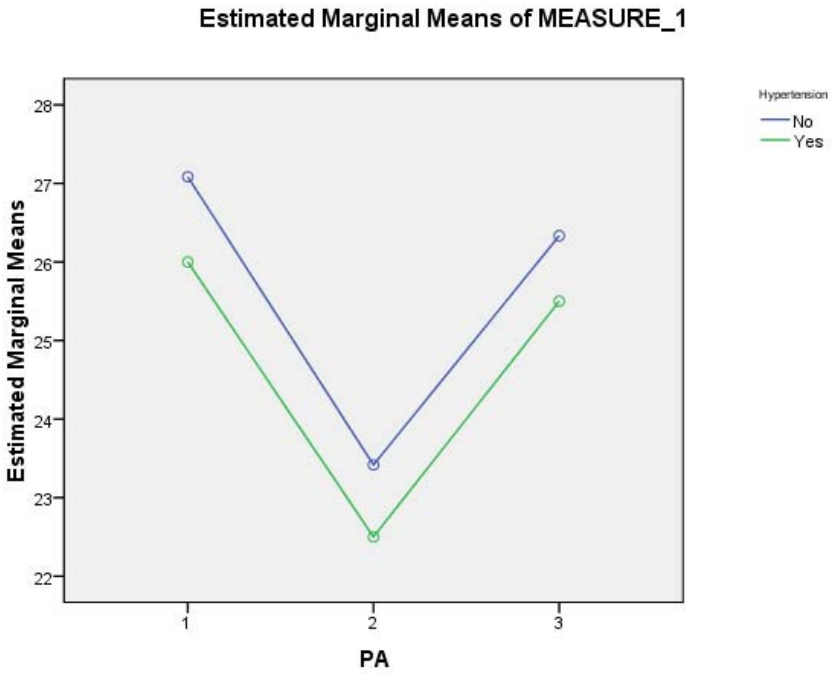


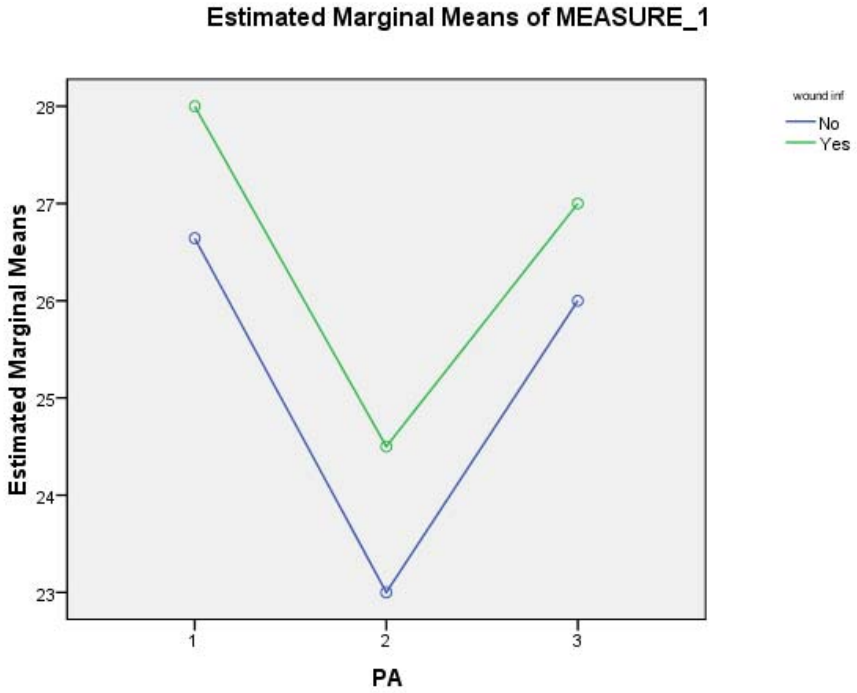
Graphs for analysis of prealbumin in Bilat replacement (Tables 40,41)



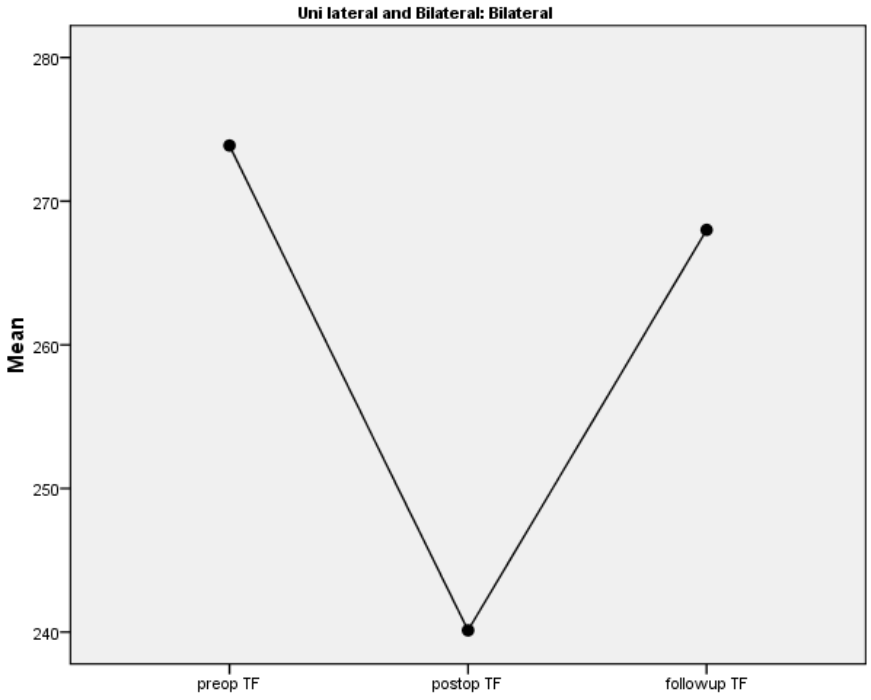


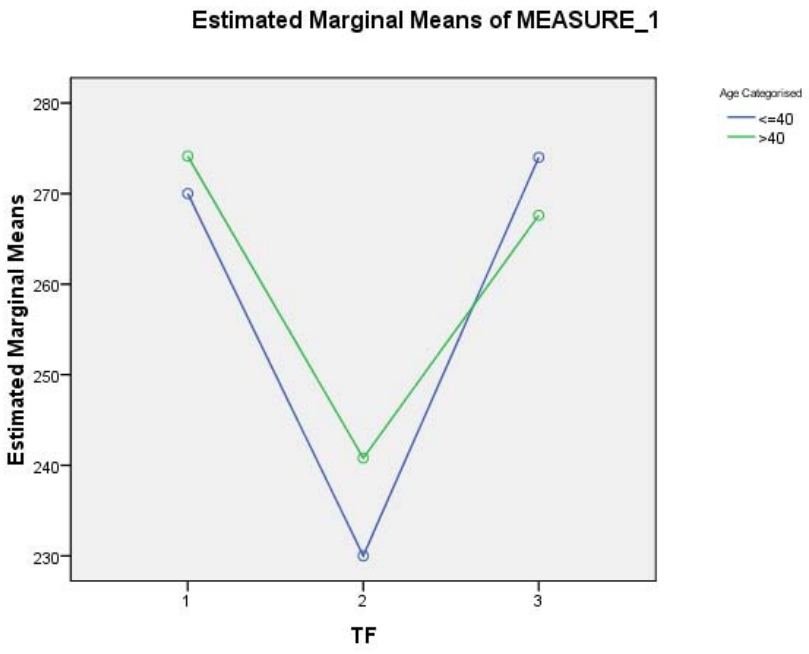
Graphs for analysis of prealbumin in Bilat replacement (Tables 42,43)



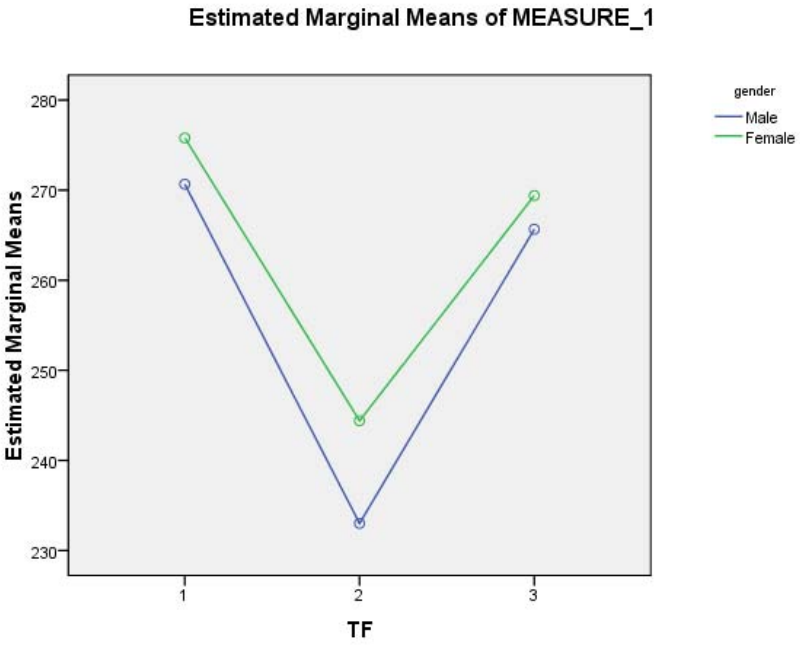


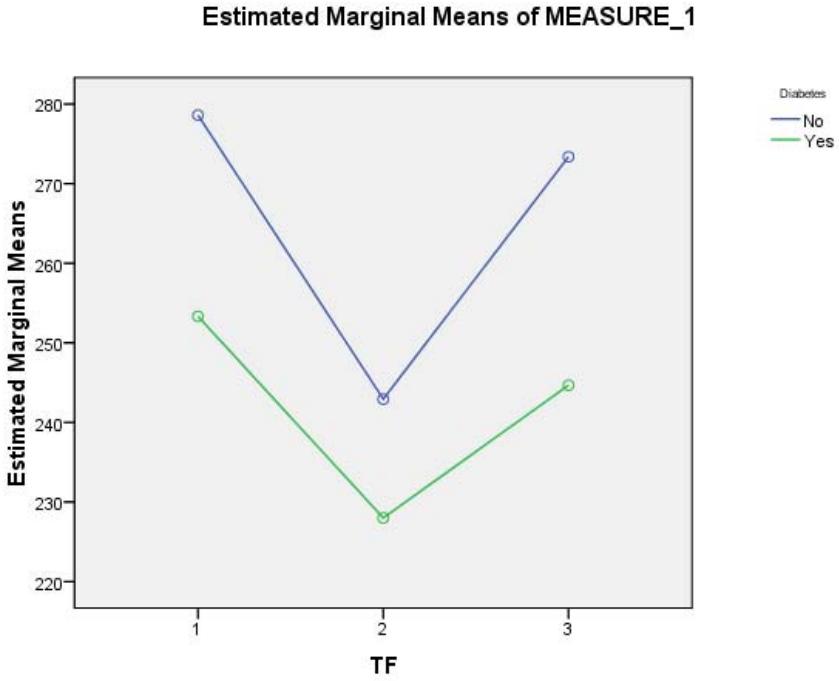
Graphs for analysis of transferrin in Bilat replacement (Table 44)



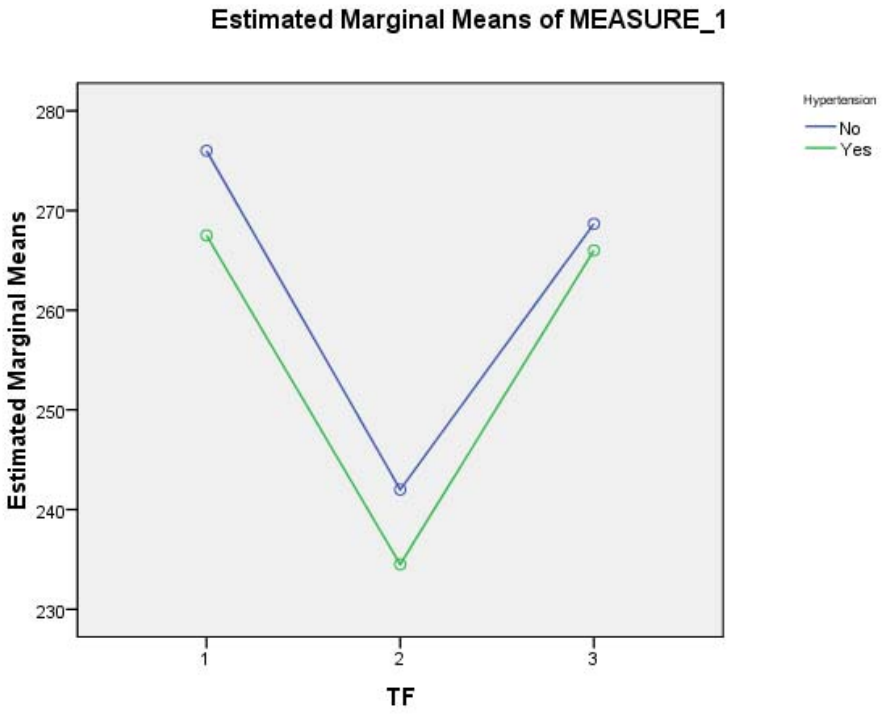


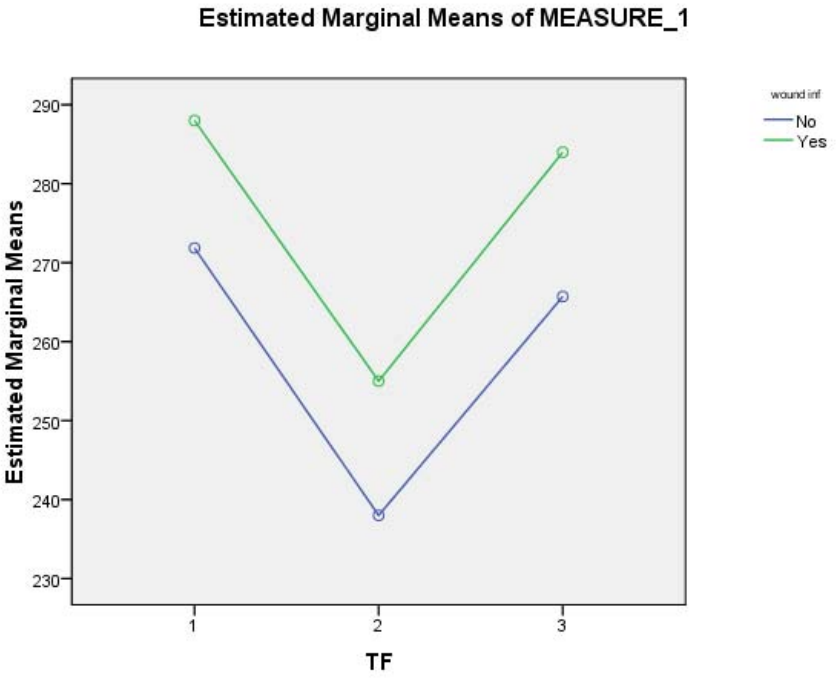
Graphs for analysis of transferrin in Bilat replacement (Tables 45,46)



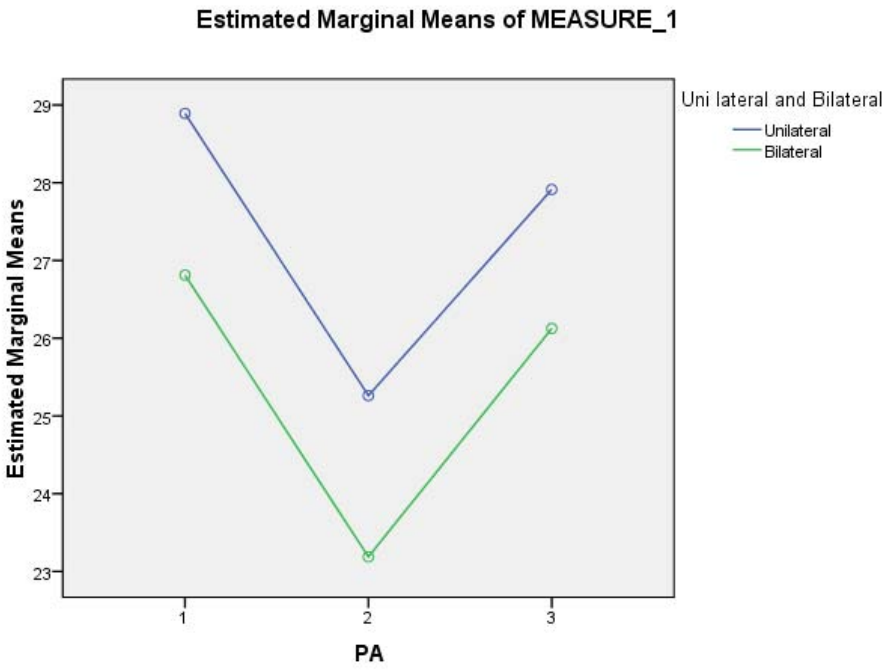


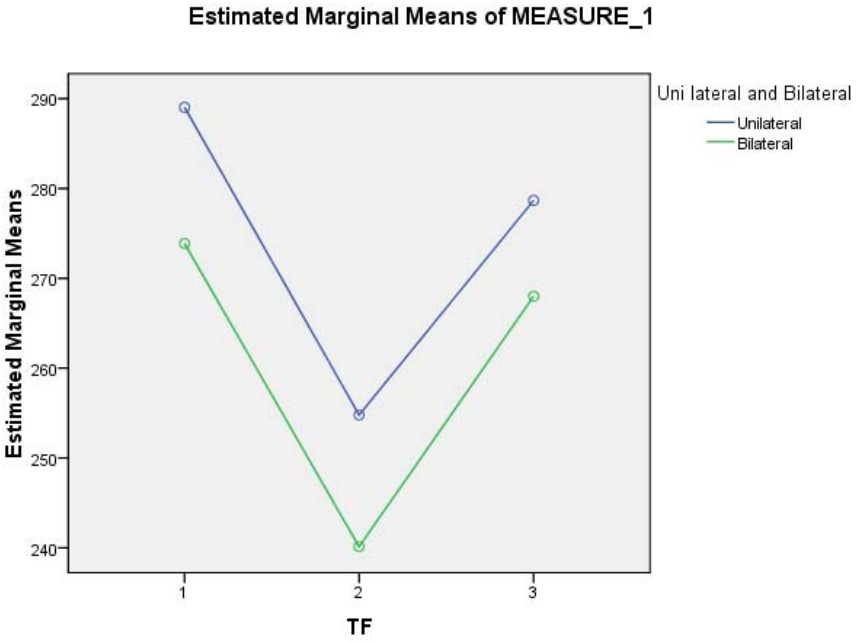
Graphs for analysis of transferrin in Bilat replacement (Tables 47,48)





Graphs for comparison between Unilateral and Bilateral replacement groups (Tables 49,50)





Unilateral TKR

The number of patients followed up – 15.

Age – 30 to 76 yrs.

Avg age – 52.9 yrs.

> 40 yrs age group – 14 pts.(93.3%)

Females – 9 pts.(60%)

Males –6 pts.(40%)

Comorbidities

DM –4 pts.(26.7 %)

HT – 3 pts. (20%)

BMI

BMI < 20 – nil.

BMI > 25 - 10 pts. (57.8%)

There was no association of BMI with the incidence of wound infection.

(Annexure – tables 97,98)

Analysis of prealbumin in Unilateral TKR group

The prealbumin values at pre op , post op and follow up of the unilateral TKR patients shows a significant difference between all three values (p value 0.000).

No statistically significant difference was observed in the pattern of prealbumin values between the variables for comparison (age group, gender, DM, HT).

Analysis of transferrin in Unilateral TKR group

The transferrin values at pre op , post op and follow up of the unilateral TKR patients shows a significant difference between all three values (p value 0.000).

No statistically significant difference was observed in the pattern of transferrin values between the variables for comparison (age group, gender, DM, HT).

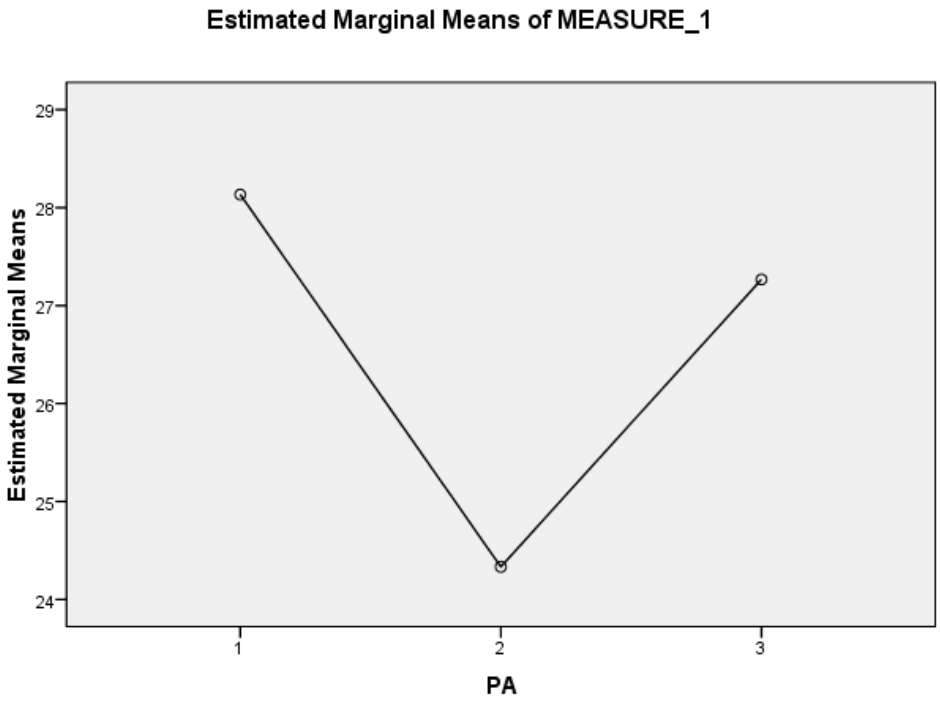
Complications

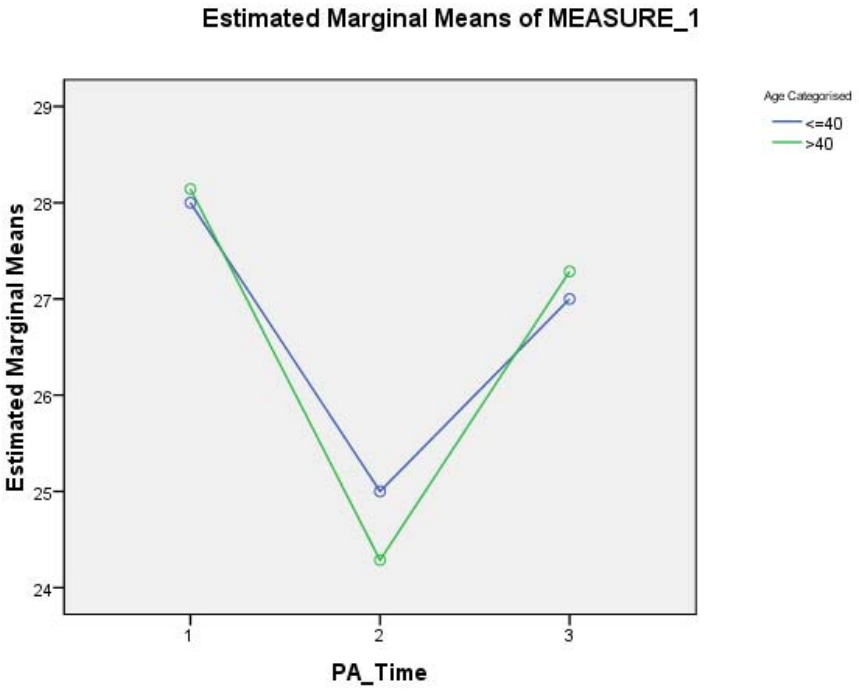
Wound infection – 3pts. (20%).

All of them were superficial infection.

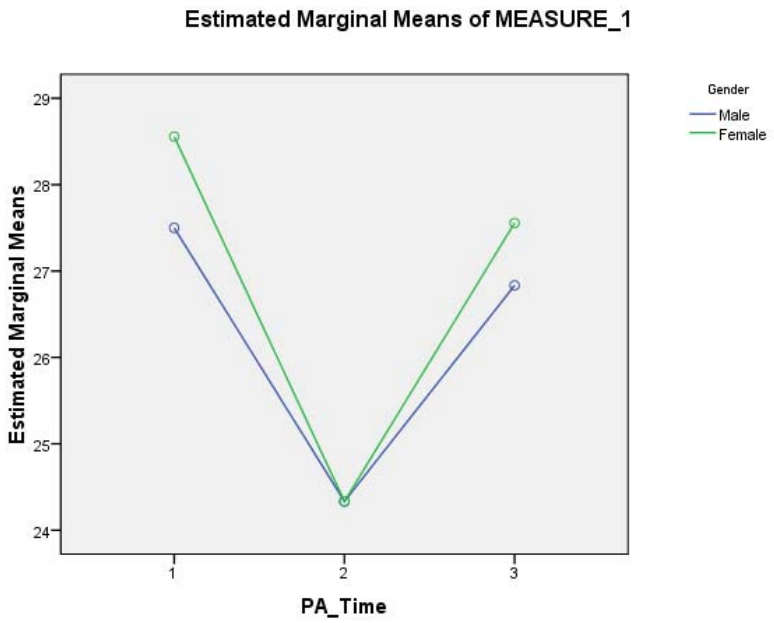
UTI –1pt. (6.7 %); It was catheter related UTI.

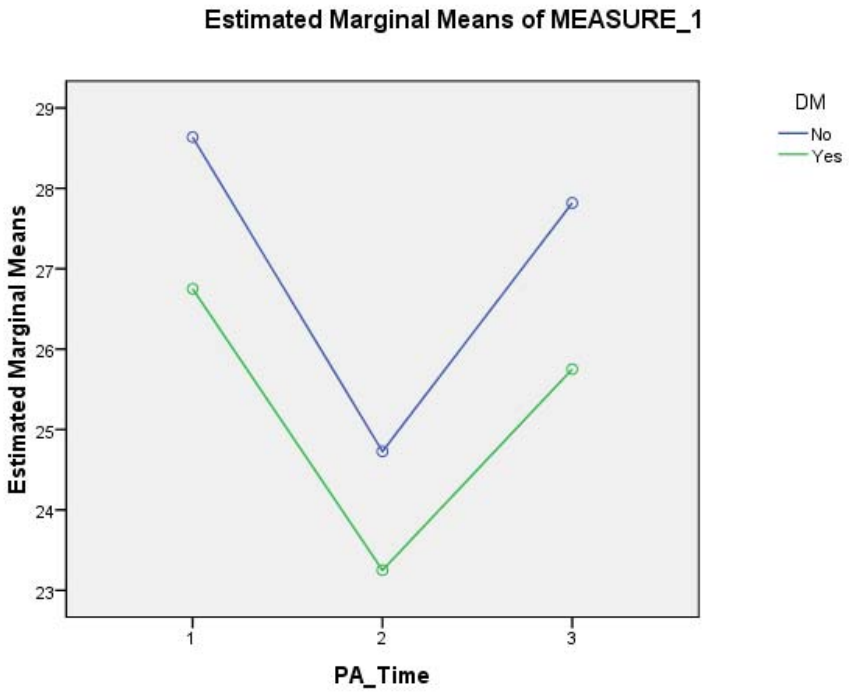
Graphs for analysis of prealbumin in Unilateral TKR (Tables 51,52)



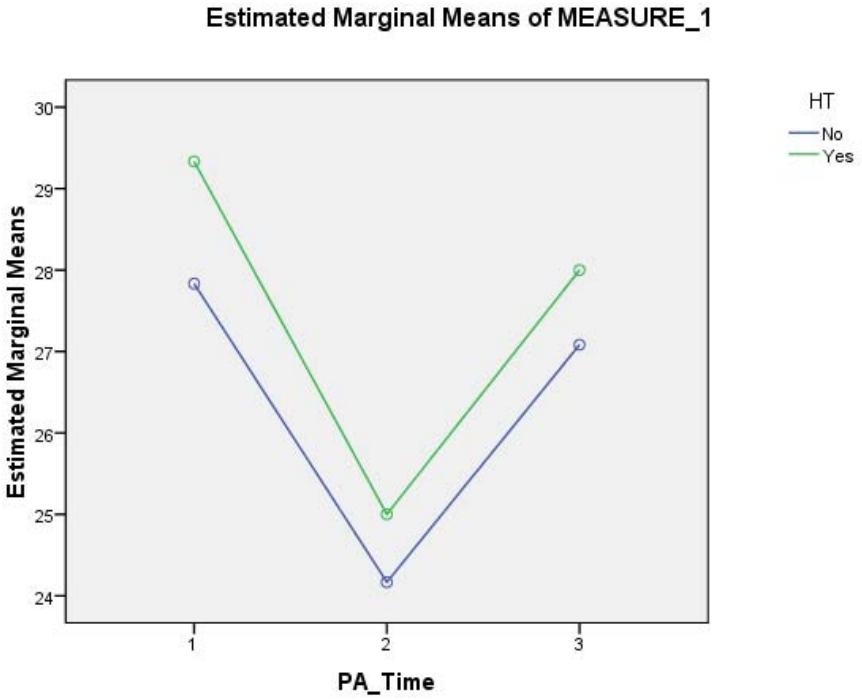


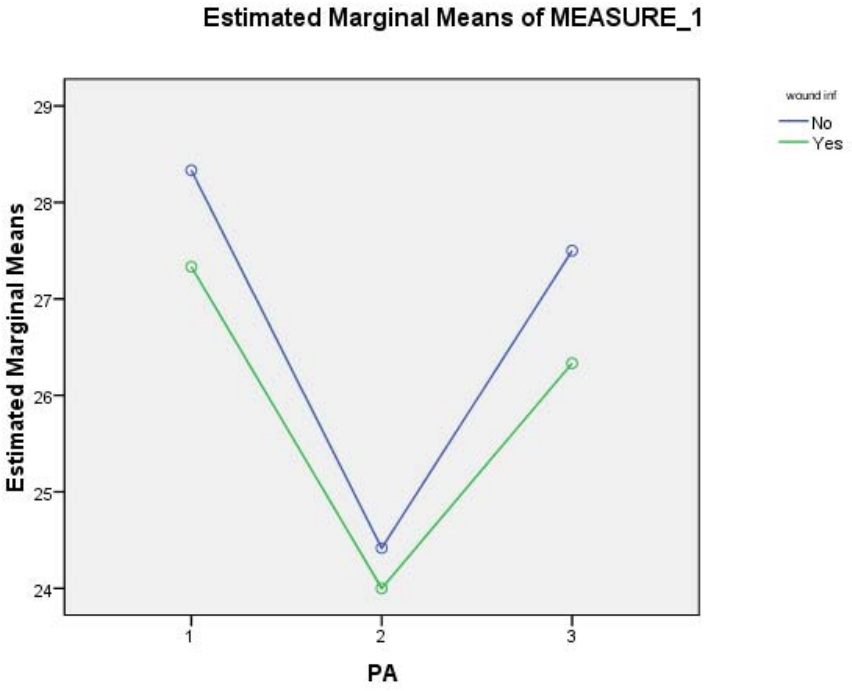
Graphs for analysis of prealbumin in Unilateral TKR(Tables 53,54)



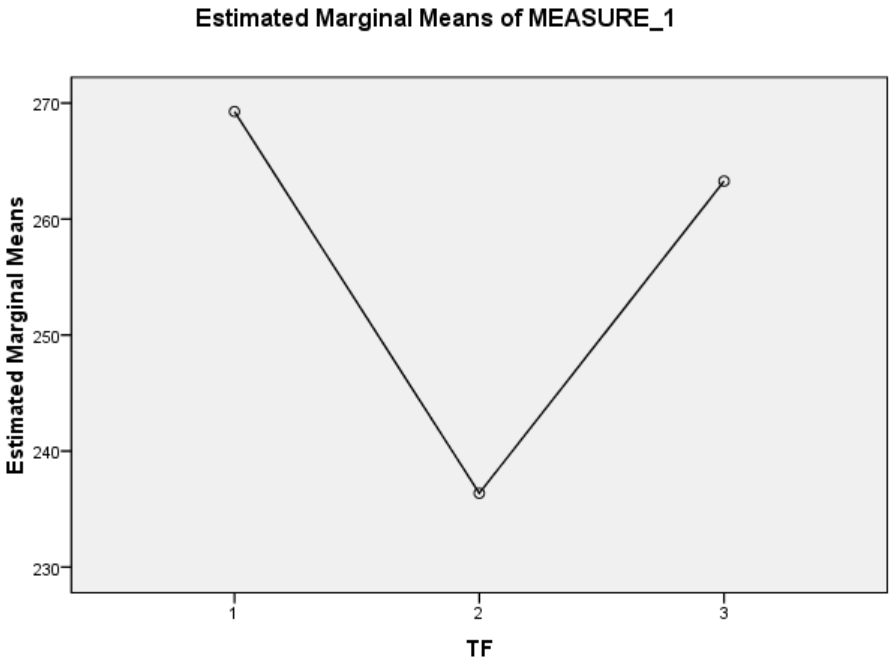


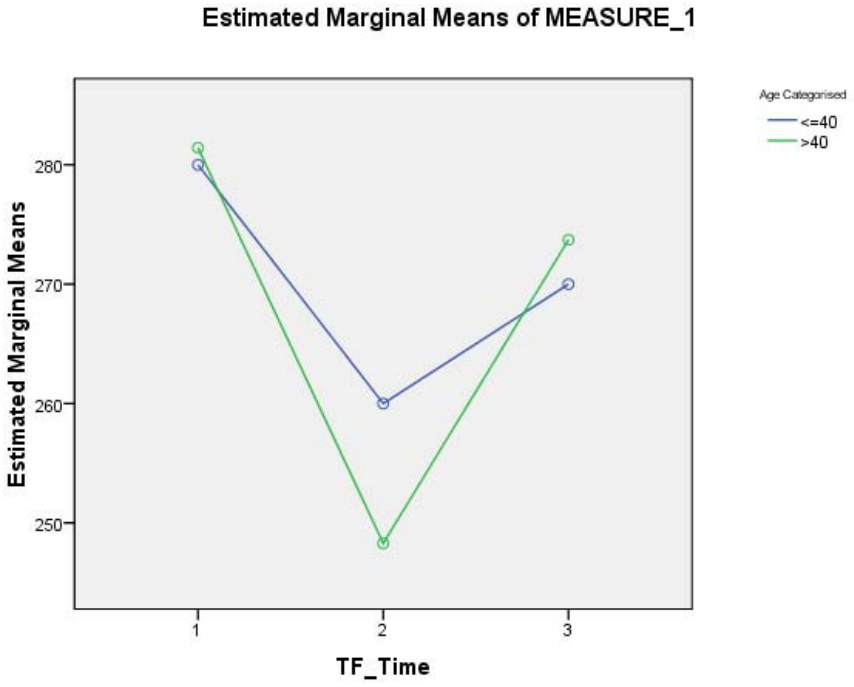
Graphs for analysis of prealbumin in Unilateral TKR(Tables 55,56)



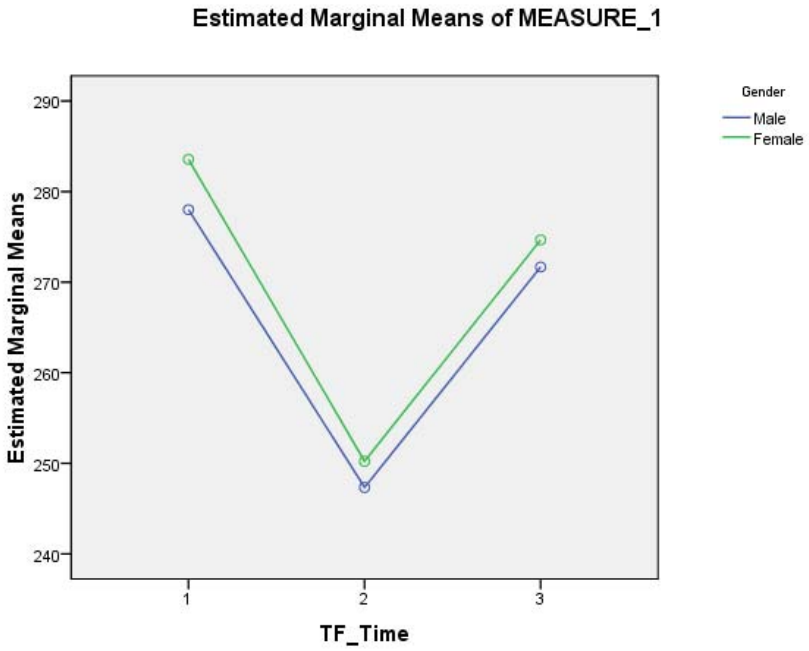


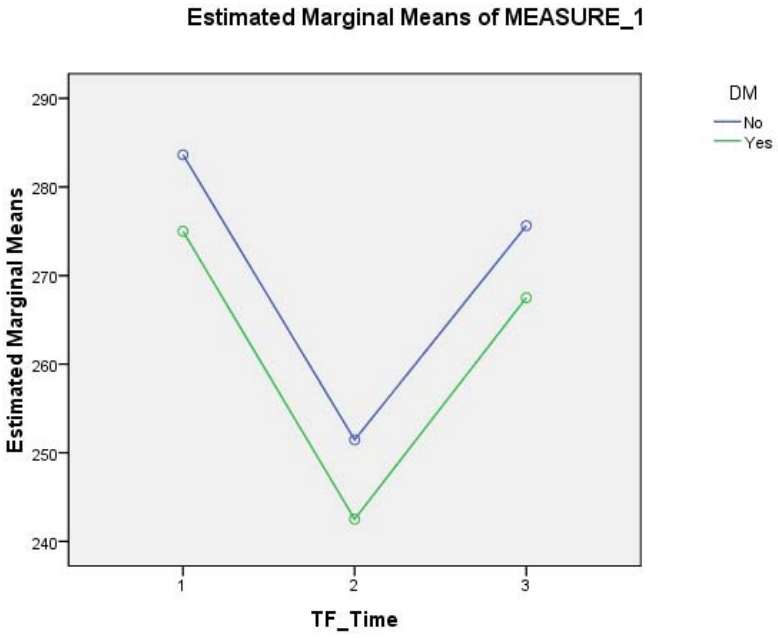
Graphs for analysis of transferrin in Unilateral TKR (Tables 57,58)



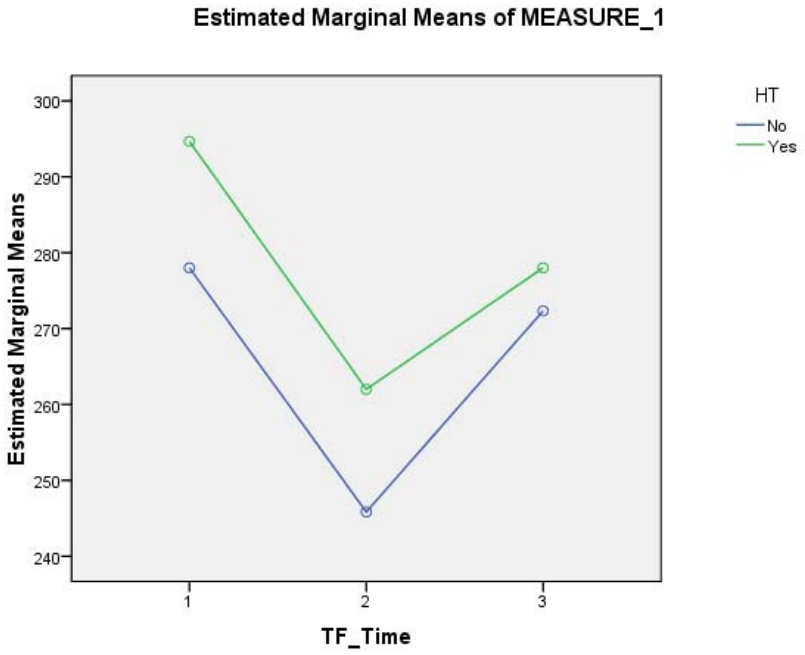


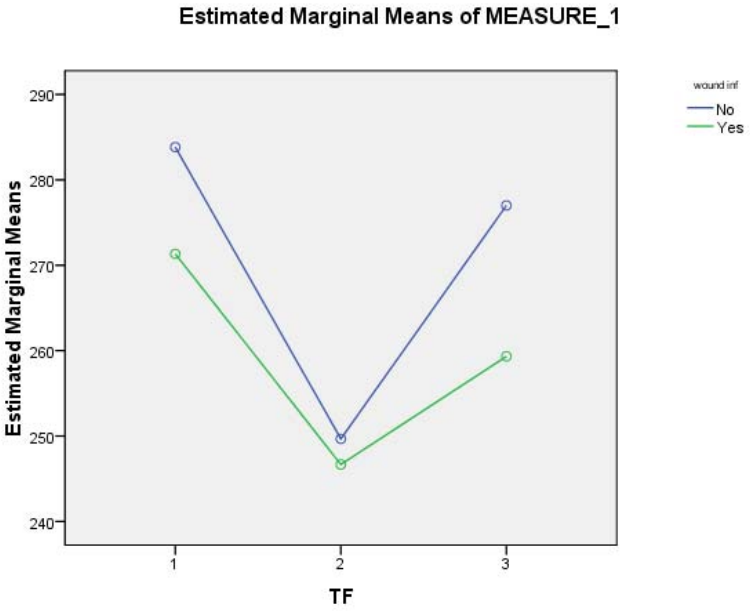
Graphs for analysis of transferrin in Unilateral TKR (Tables 59,60)





Graphs for analysis of transferrin in Unilateral TKR (Tables 61,62)





Bilateral TKR

The number of patients followed up – 11.

Age – 30 to 72 yrs.

Avg age – 54.45 yrs.

> 40 yrs age group – 10 pts.(90.9%)

Females – 9 pts.(81.8%)

Males – 2 pts.(18.2%)

Comorbidities

DM – 3 pts.(27.3 %)

HT – 3 pts.(27.3 %)

RA – 3 pts.(27.3 %)

BMI

BMI < 20 – nil.

BMI > 25 - 5 pts (45.5%)

No association of BMI with UTI or wound infection. (Annexure – tables 99 to 102).

Analysis of prealbumin in Bilateral TKR group

The prealbumin values at pre op , post op and follow up of the bilateral TKR patients shows a significant difference between all three values (p value 0.000).

No statistically significant difference was observed in the pattern of prealbumin values between the variables for comparison (age group, gender, HT) except in diabetics (p value 0.02).

Analysis of transferrin in Bilateral TKR group

The transferrin values at pre op , post op and follow up of the bilateral TKR patients shows a significant difference between all three values (p value 0.000).

No statistically significant difference was observed in the pattern of transferrin values between the variables for comparison (age group, gender, DM, HT).

Complications

Wound infection – 1 pt. (9.1%) ; It was a superficial infection.

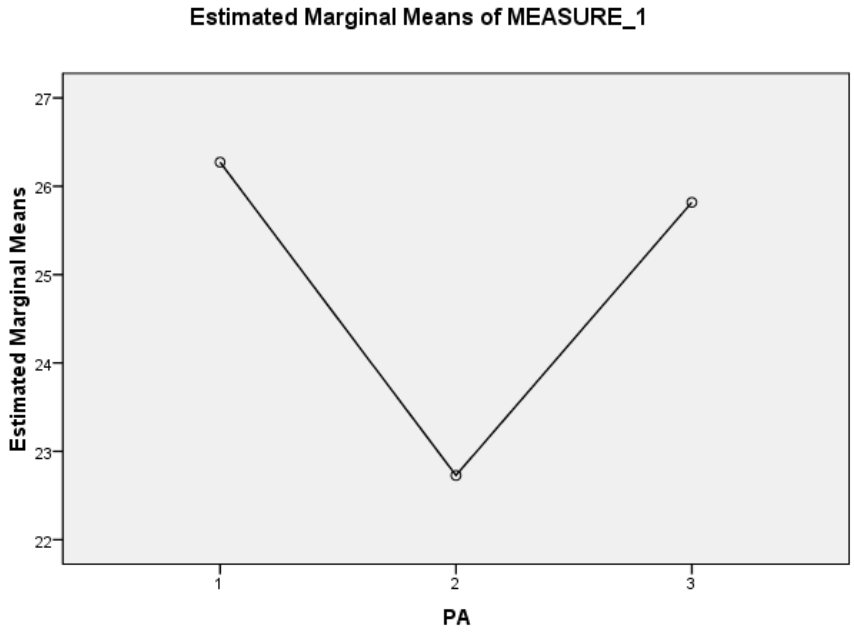
UTI – 1 pt. (9.1 %); It was a catheter related UTI.

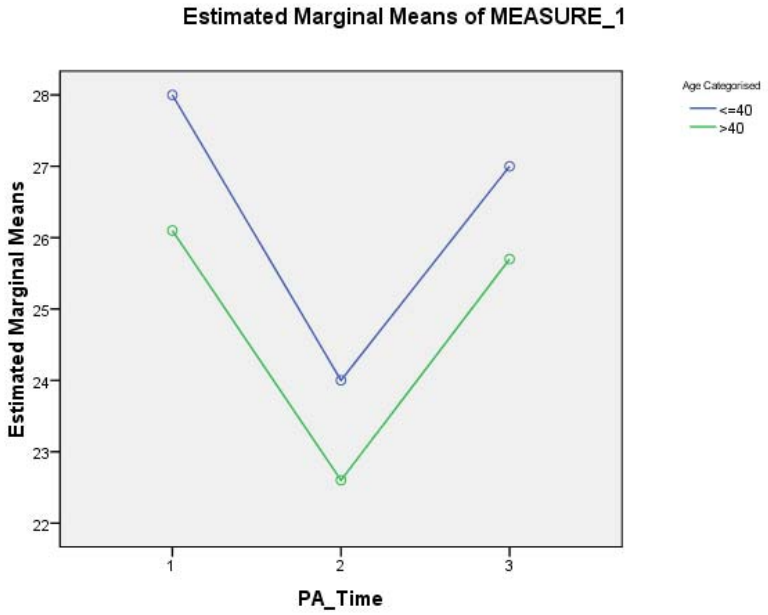
Wound infection have a tendency to occur in overweight (p value 0.145).

Comparison between Unilateral and Bilateral TKR groups.

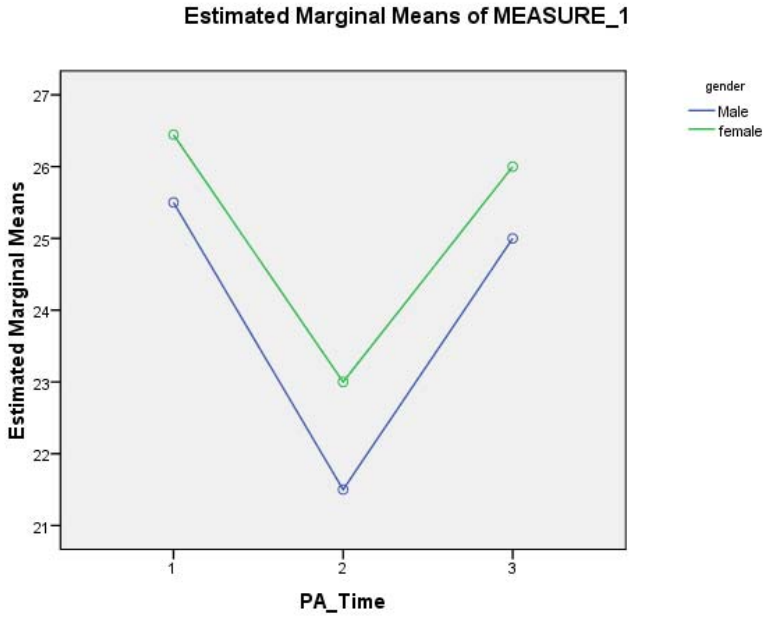
Both prealbumin and transferrin values shows no statistically significant difference between the Unilateral and Bilateral TKR groups in the pattern of prealbumin and transferrin values.

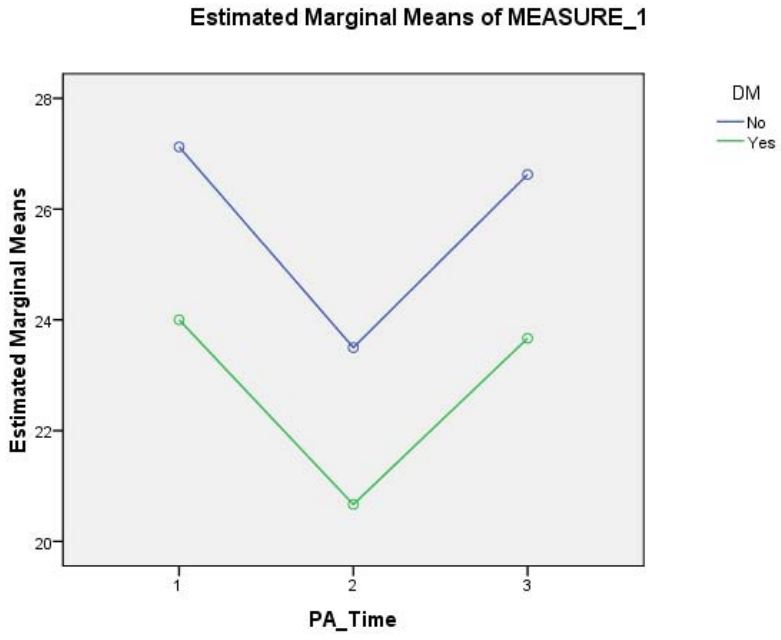
Graphs for Analysis of prealbumin in Bilateral TKR (Tables 63,64)



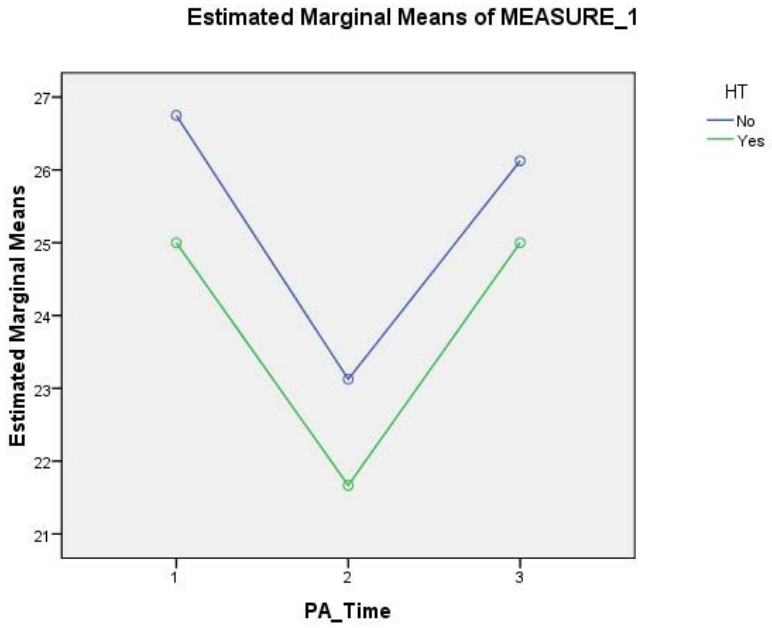


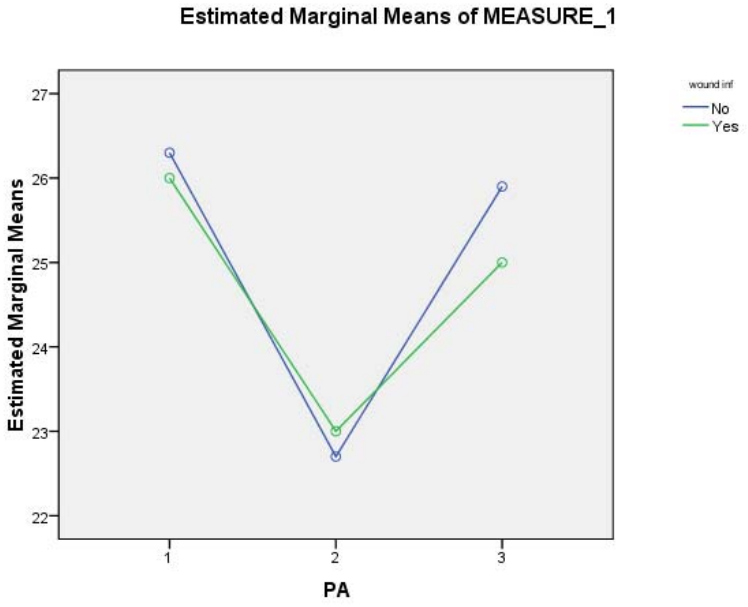
Graphs for Analysis of prealbumin in Bilateral TKR (Tables 65,66)



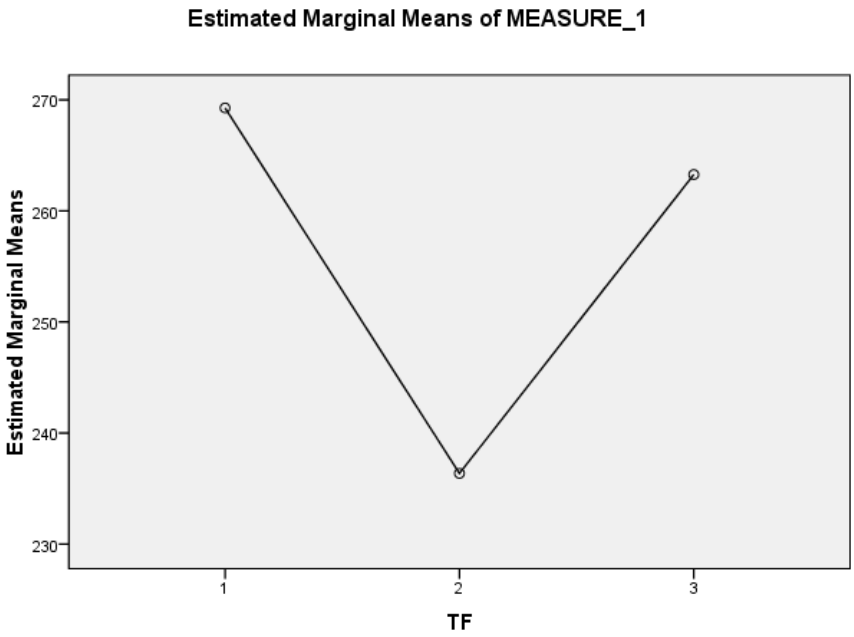


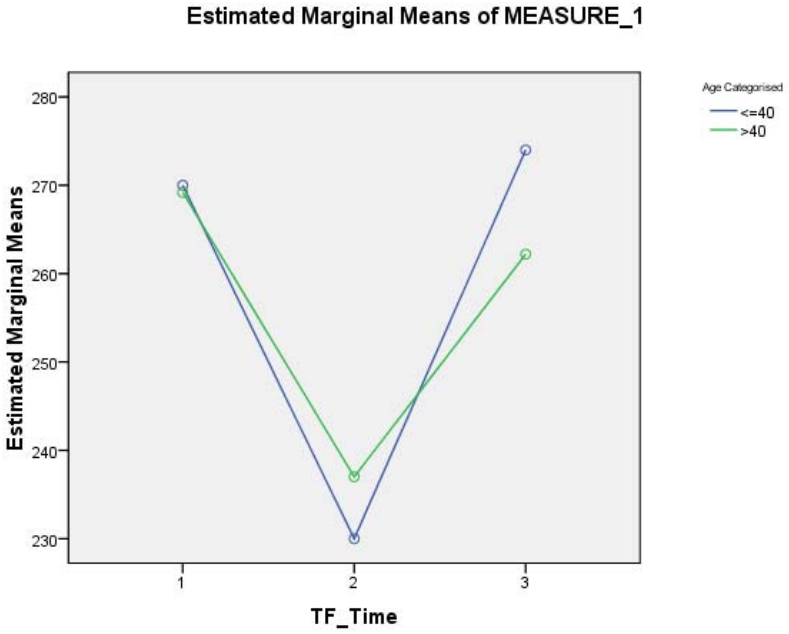
Graphs for Analysis of prealbumin in Bilateral TKR (Tables 67,68)



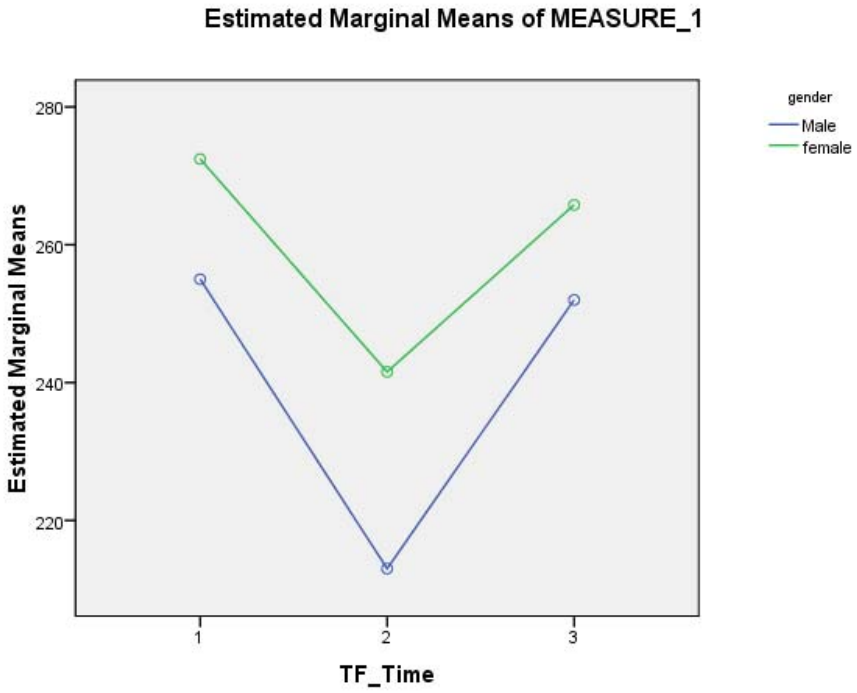


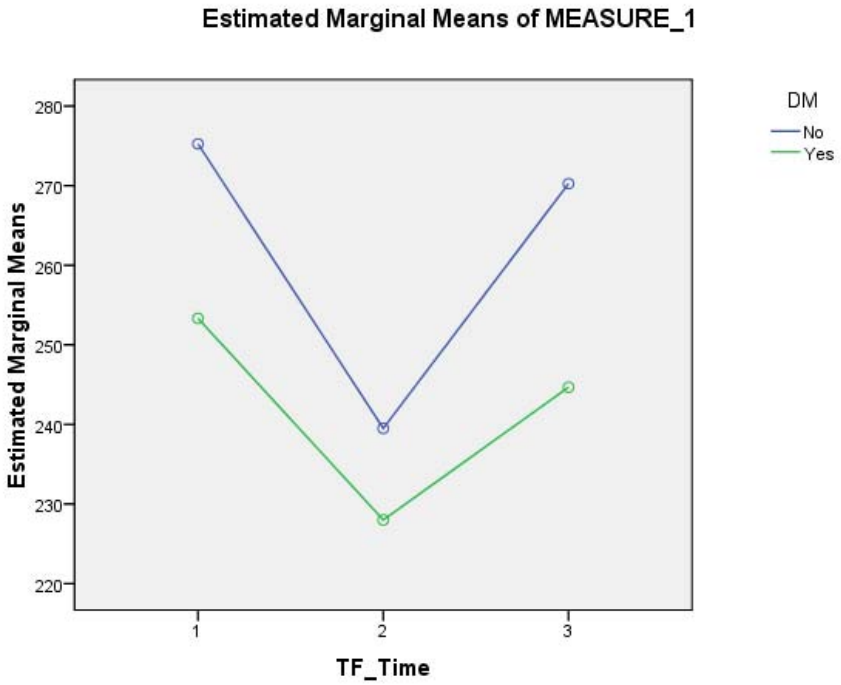
Graphs for analysis of transferrin in Bilateral TKR (Tables 69,70)



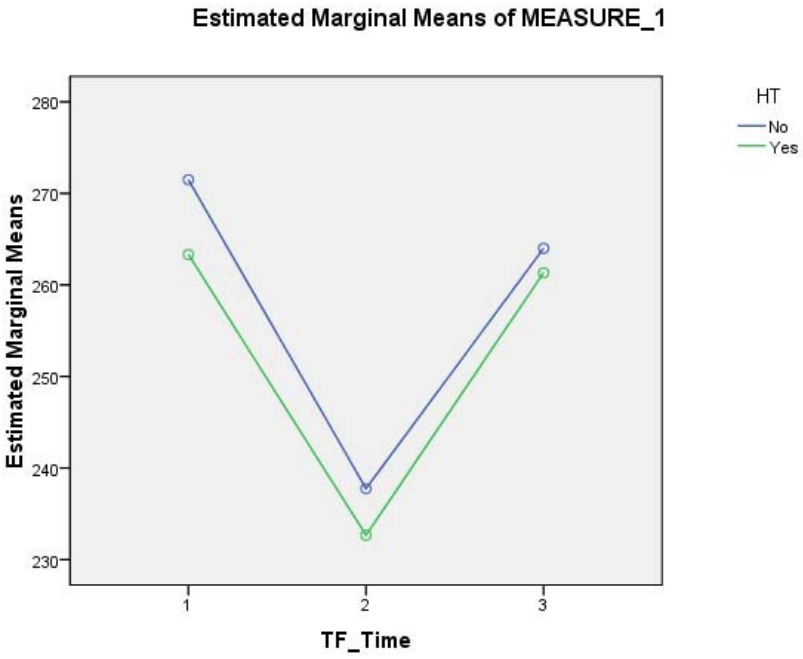


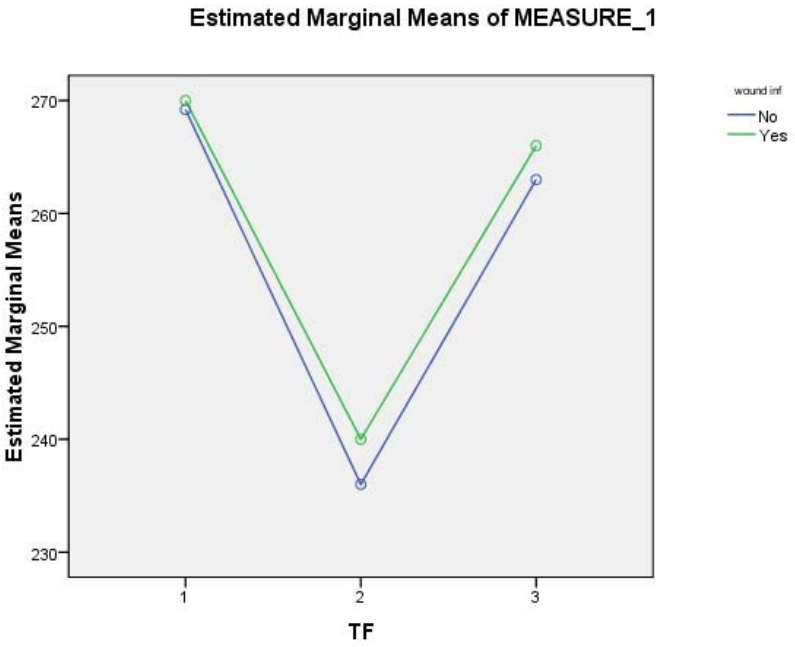
Graphs for analysis of transferrin in Bilateral TKR (Tables 71,72)



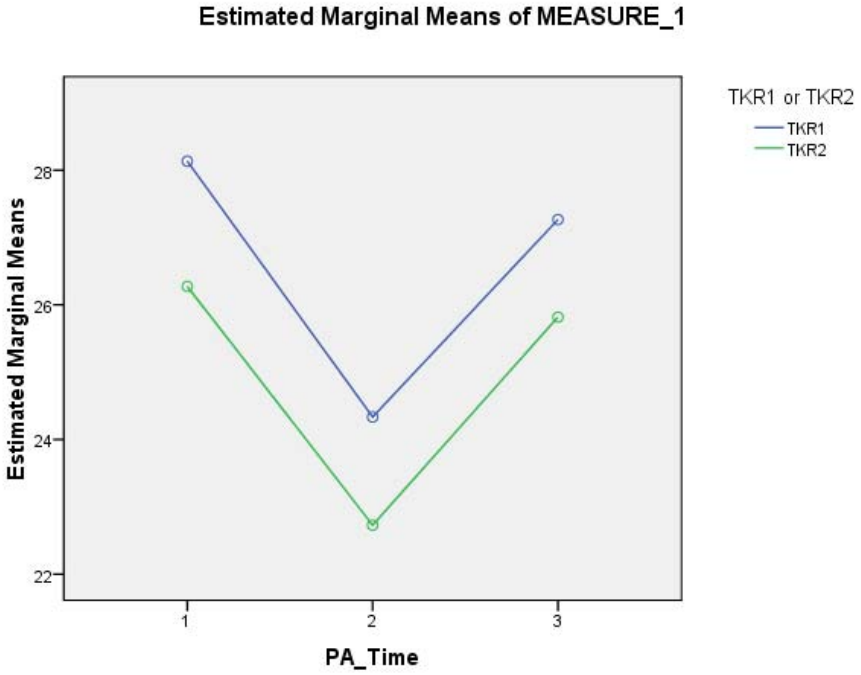


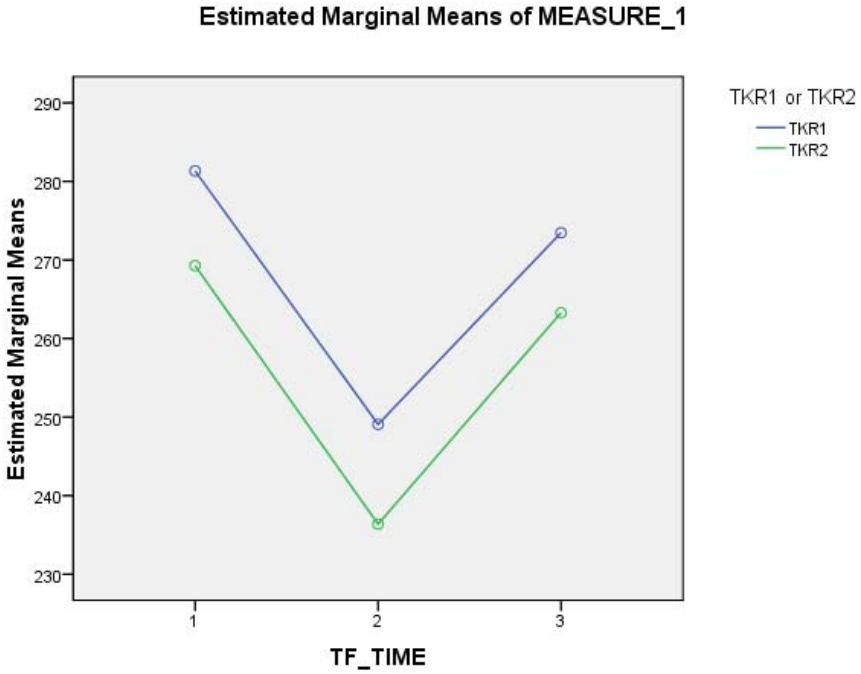
Graphs for analysis of transferrin in Bilateral TKR (Tables 73,74)





Graphs for comparison of Unilateral and Bilateral TKR (Tables 75,76)





Unilateral THR

The number of patients followed up – 31.

Age	– 21 to 74 yrs.
Avg age	– 47.54 yrs.
> 40 yrs age group	–21pts. (67.7%)
Females	– 11 pts.(35.5%)
Males	– 20 pts. (64.5%)

Comorbidities

DM – 2 pts. (6.5 %)

HT – 5 pts. (16.12%)

BMI

BMI < 20 – 1 pt (3.2 %).

BMI > 25 - 8 pts. (26.9%).

No assocation of BMI with incidence of wound infection.

(Annexure – tables 103,104).

Analysis of prealbumin in Unilateral THR group.

The prealbumin values at pre op , post op and follow up of the unilateral THR patients shows a significant difference between all three values (p value 0.000).

Statistically significant difference was observed in the pattern of prealbumin values in hypertensives (p value 0.014)and when comparing the age groups (p value 0.000).

Patients with wound infection showed significant difference in the pattern of values but was not statistically significant (p value – 0.154).

Analysis of transferrin in Unilateral THR group.

The transferrin values at pre op , post op and follow up of the unilateral THR patients shows a significant difference between all three values (p value 0.000).

Statistically significant difference was observed in the pattern of transferrin values in hypertensives (p value 0.009) and when comparing the age groups (p value 0.000).

Patients with wound infection showed significant difference in the pattern of values but was not statistically significant (p value – 0.171).

Complications

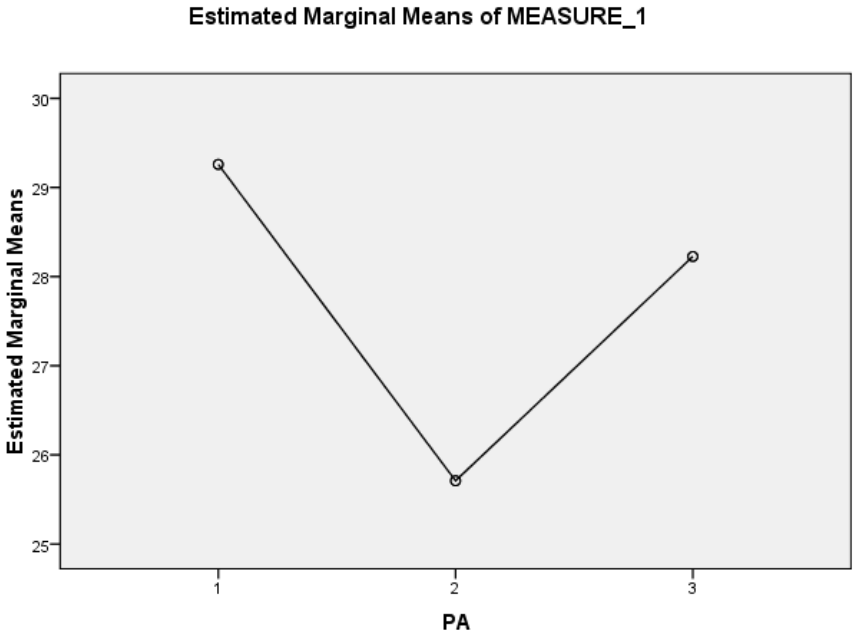
Wound infection – 4 pts.(16.2%).

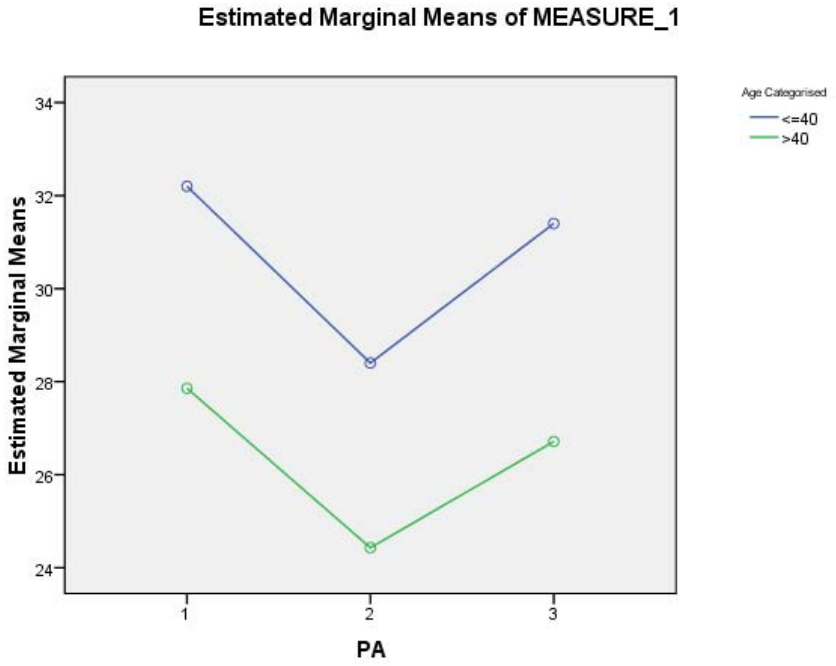
2 of them were deep infection and 2 superficial infection .

Comparison between unilateral TKR and THR

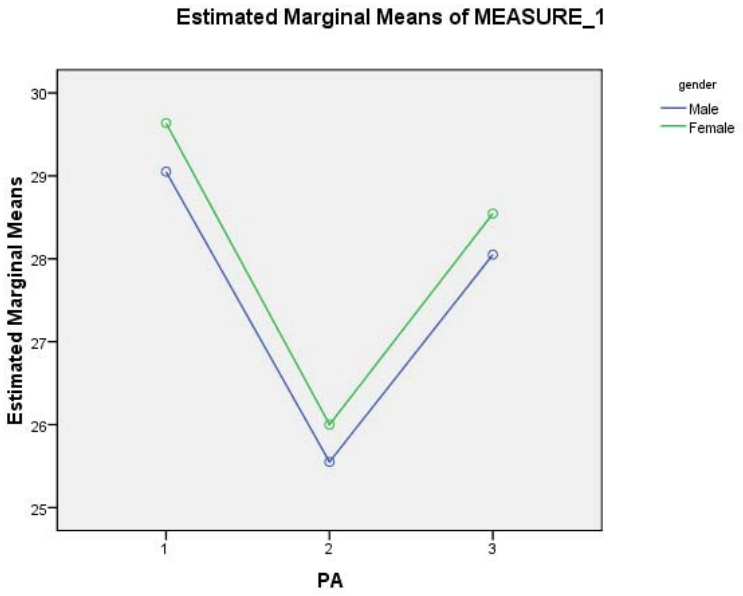
There was no statistically significant difference between the groups in the pattern of both Prealbumin and Transferrin values.

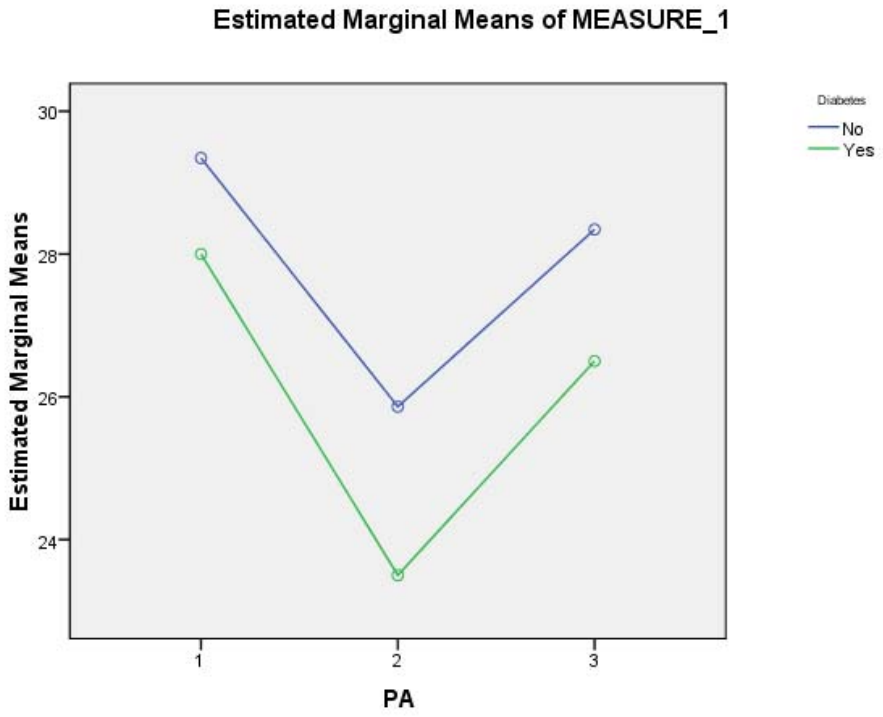
Graphs for analysis of prealbumin in unilateral THR (Tables 77,78)



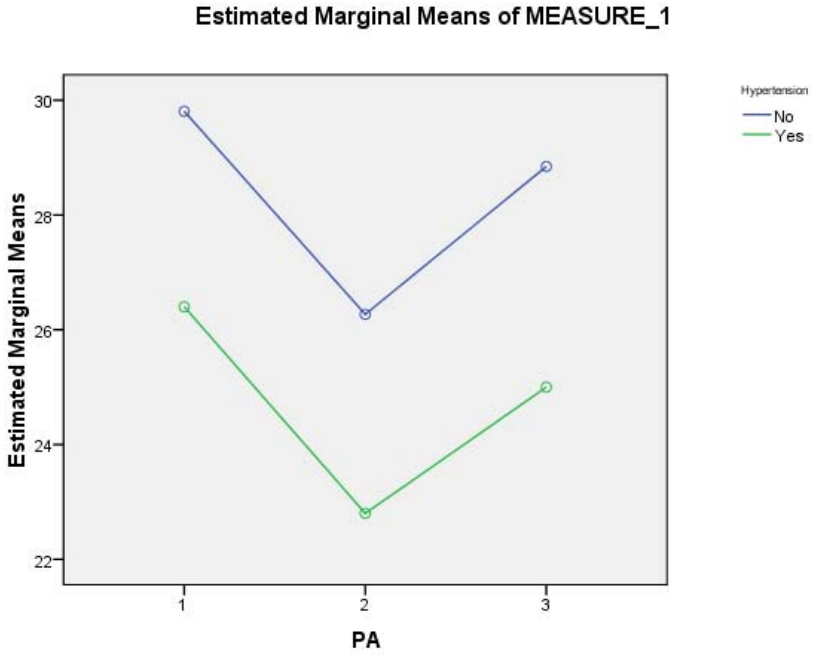


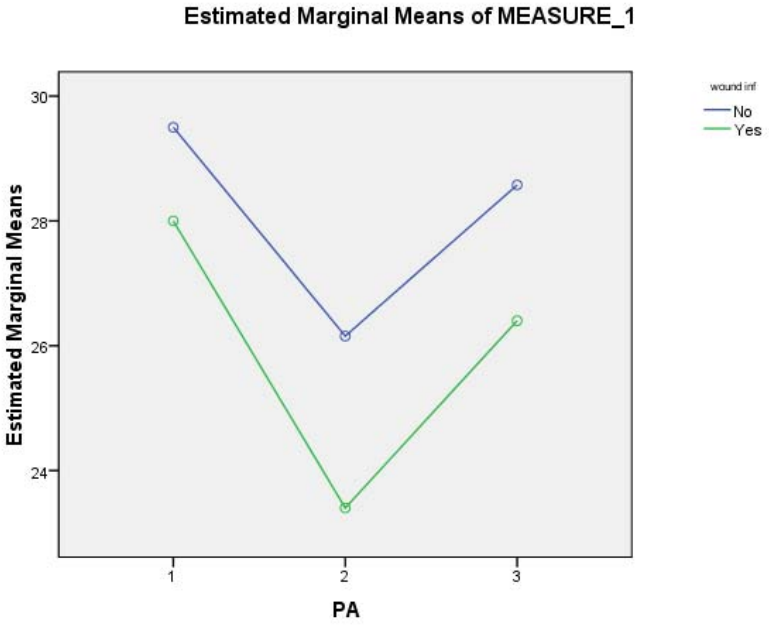
Graphs for analysis of prealbumin in unilateral THR (Tables 79,80)



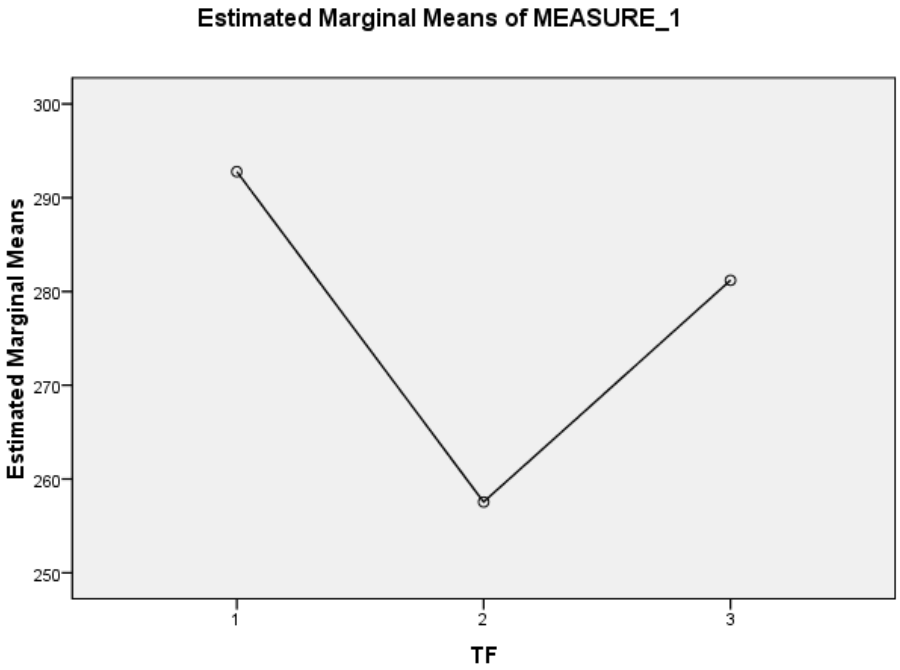


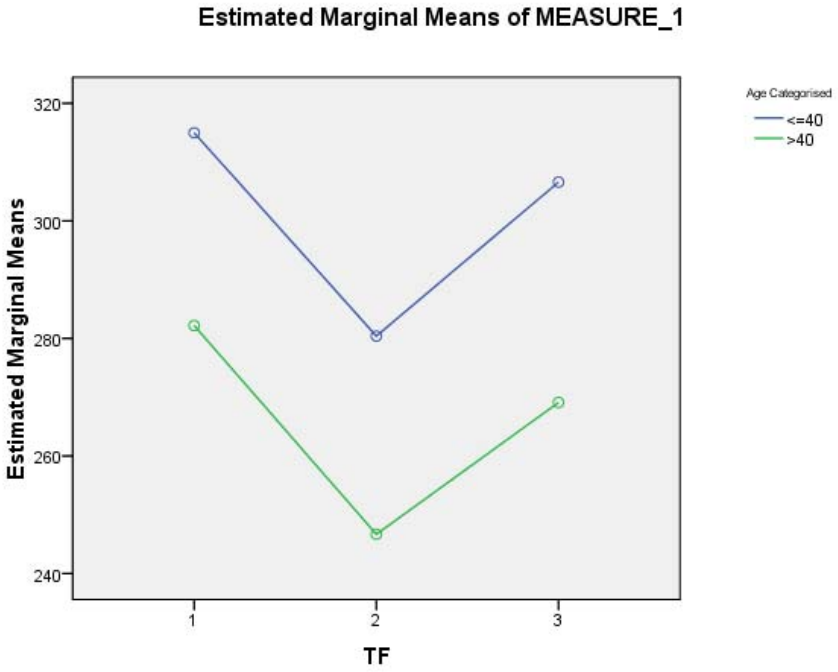
Graphs for analysis of prealbumin in unilateral THR (Tables 81,82)



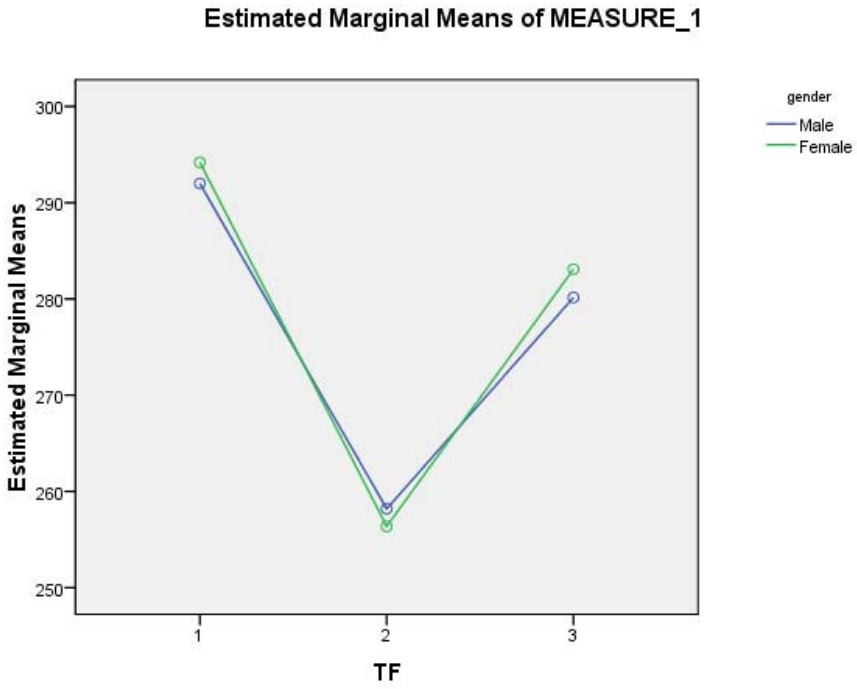


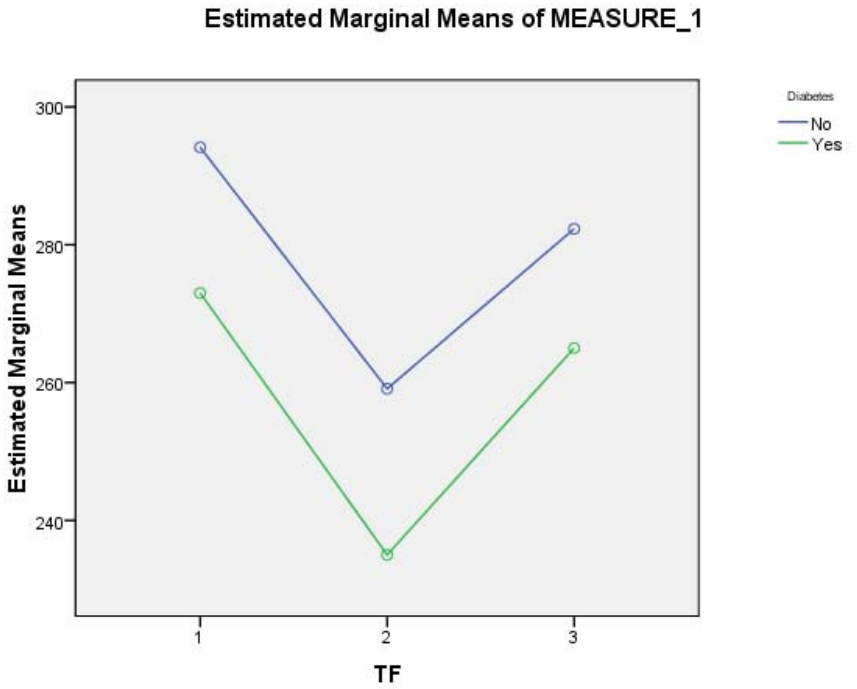
Graphs for analysis of transferrin in Unilateral THR (Tables 83,84)



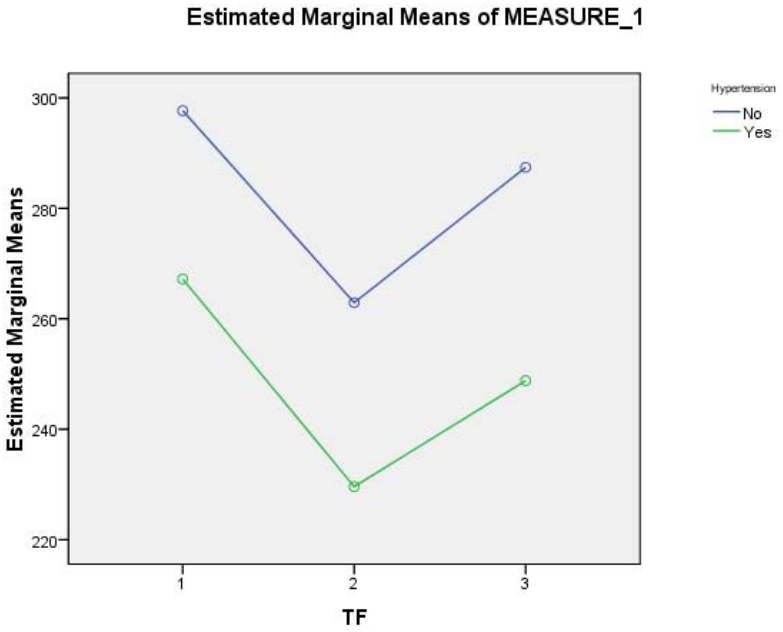


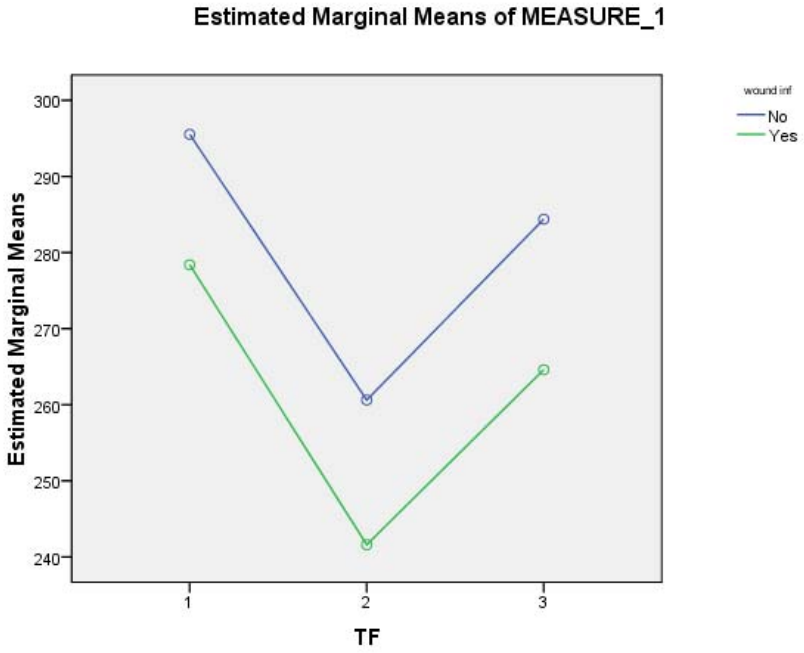
Graphs for analysis of transferrin in Unilateral THR (Tables 85,86)



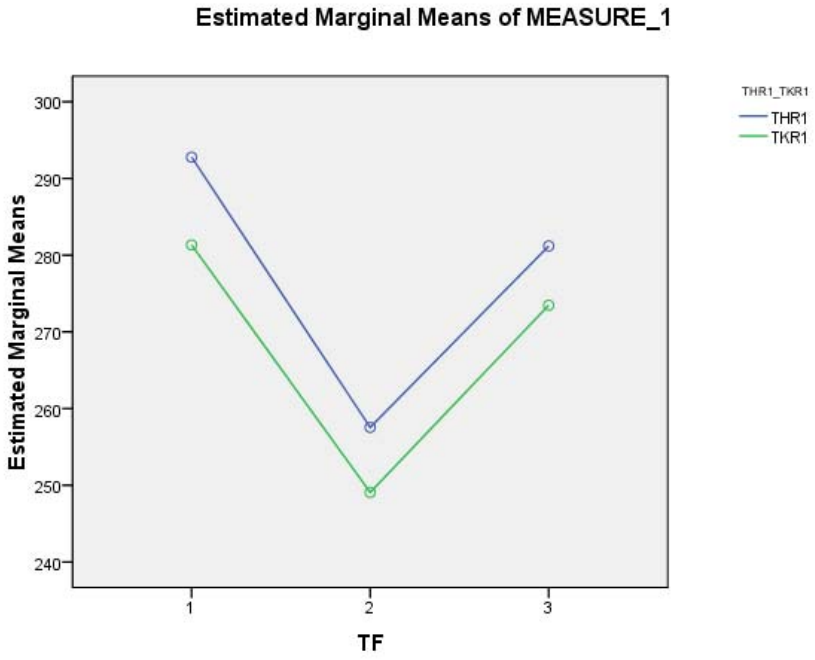


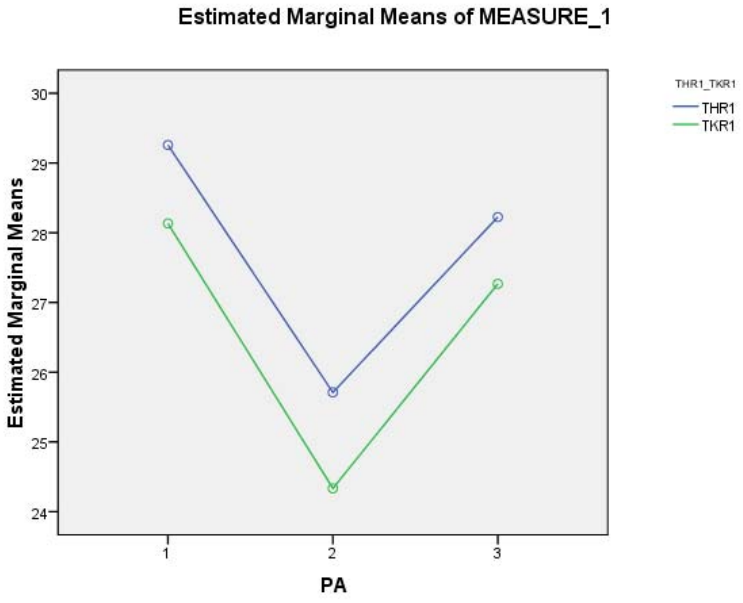
Graphs for analysis of transferrin in Unilateral THR (Tables 87,88)





Graphs for comparison of Unilateral THR and TKR (Tables 89,90)





DISCUSSION

This prospective study was designed to analyze the effect of major orthopaedic surgery on the nutritional status of the patients. The results of the study shows significant difference in the pre op, post op and the follow up values of biochemical marker – Prealbumin and transferrin, in all groups of patients. This indicate that the trauma of hospitalisation , surgery and anaesthesia does affect the nutritional status of the patient, as described in various other studies[10-14].

The incidence of undernutrition in this study was found to be 4.42%, where as the literature quotes values around 40% in orthopaedic inpatients [37-41]. This may be due to the patient selection criteria. We included only those patients who were undergoing planned elective major orthopaedic surgery. We excluded the patients admitted for surgery for trauma and tumours. More over many of them were overnourished (BMI > 25 – 33.62%). Most of the literature on malnutrition in orthopaedics are on trauma , especially hip trauma in the elderly[42-45]. These might be reasons for the gross difference in the incidence of malnutrition in our study.

The biochemical parameters, even though are much better at follow up compared to the post op level, do not come back to the pre op level even at 3

months. This indicate that these patients need to be followed up further to know when actually the parameters come back to the pre op level.

Diabetes and **age > 40 yrs** are the two important factors that affect the nutritional recovery of the patients undergoing major orthopaedic trauma in our study. The relationship between age and the nutritional status in orthopaedic patients have been extensively studied especially in hip fractures in elderly[42-45].

PLIF patients tend to behave significantly different in their nutritional status compared to Infective Spondylitis patients. This may be due to the effect of infection, often chronic diseases like tuberculosis, on the nutritional status and parameters. Unilateral replacement patients as a whole also tend to behave differently compared to their bilateral counter parts.

There were no difference in the behaviour of nutritional parameters between unilateral and bilateral TKR patients. There were no difference in the behaviour of nutritional parameters between unilateral THR and TKR patients.In bilateral TKR patients , over weight patients were predisposed to wound infection.

Only in unilateral THR patients, hyperrtension gains significance as a factor affecting the pattern of changes in the nutritional marker levels.A presumed cause offered can be related to the blood loss during surgery.

The wound infections in the patients in our study did not correlate with their nutritional status even though literature quotes positive correlation between the two[62-67]. This may be due to the fact that undernutrtion was detected only in 4.42% of the study population.

The incidence of UTI was found to be correlating with presence of urinary catheter and parplegics in infective spondylitis group.

In our study , Prealbumin correlate with the nutritional status better than transferrin. Even though studies have shown the effectiveness of transferrin as a nutritional marker[52], Prealbumin may be a better marker for the nutritional assessment.

CONCLUSION

This prospective study clearly shows the effects of major elective orthopaedic surgery on the nutritional status of the patients. The three important conclusions of our study are –

1. Age > 40is the main patient related factor that affect the nutritional status of patients undergoing major elective orthopaedic surgery.
2. Among the comorbidities, diabetes mellitus affects the nutrtional status of the patients undergoing major elective orthopaedic surgery.
3. This study also shows the effectiveness of prealbumin as a reliable nutritional marker. Prealbumin can be used routinely in patients at risk of malnutrition to assess and to take appropriate nutritional measures toprevent complications.
4. Possibly prealbumin is a better indicator of nutritional status than transferrin.

LIMITATIONS OF THE STUDY

1.Small sample size – Since the incidence of malnutrition in our study was only 4.42% compared to 40% in the literature, a bigger sample size would have given a better and clearer picture .

2. Short follow up - At 3 months follow up , the biochemical parameters had not come back to pre op level. So a longer follow up would have possibly shown the time taken for the parameters to normalize after surgery.

3. Patient selection – We did not include trauma and tumour patients in our study . These patient groups are more vulnerable to nutritional depletion and a similar study on those patient groups would be valuable.

BIBLIOGRAPHY

1.Coats KG, Morgan SL, Bartolucci AA, Weinser RL. Hospital associated malnutrition: a re-evaluation 12 years later. J Am Diet Assoc 1993;93:27–33.

2.McWhirter JP, Pennington CR. Incidence and recognition of malnutrition in hospital. BMJ 1994;308:945–8.

3.Bistrian BR, Blakburn GL, Vitale J, Cochran D, Naylor J. Prevalence of malnutrition in general medical patients. JAMA 1976;235: 1567–70.

4.Roubenoff R, Roubenoff RA, Preto J, Balke CW. Malnutrition among hospitalized patients. A problem of physician awareness. Arch Intern Med 1987;147:1462–5.

5.Gianluigi Devoto, Fabrizio Gallo, Concetta Marchello, Omar Racchi, Roberta Garbarini, Stefano Bonassi etal . Prealbumin Serum Concentrations as a Useful Tool in the Assessment of Malnutrition in Hospitalized Patients . Clinical Chemistry 52:12 (2006).

6.Allison SP. Malnutrition disease and outcome .Nutrition 2000;16:590 – 593.

7.Jeejeebhoy KN. Nutritional assessment .Nutrition 2000;16:585-590.

8.Roubenoff R. The pathophysiology of wasting in the elderly . Journal of Nutrition 1999;129:256s-259s.

9.Pilchard C, Jeejeebhoy KN .Muscle dysfunction in malnourished patients . Quarterly Journal of medicine 1988 ; New series 69;1021-1045.

10.Wilmore DW. Post operative protein sparing. World Journal of Surgery 1999;23:545-552.

11.Emery PW, Zadeh ARB, Waslyk A . The effect of malnutrition on the metabolic response to surgery. British Journal of nutrition 1999;81:115-120.

12.Witte MB, Barbul A. General principles of wound healing. Surgical Clinics of North America 1997;77:509-528.

13.Himes D. Protein Calorie Malnutrition and Involuntary Weight Loss: the role of aggressive nutritional intervention in wound healing ; Ostomy / wound management 1999;45:46-55.

14.Dempsey DT, Mullen JL, Buzby GP .The link between nutritional status and clinical outcome ; can nutritional intervention modify it ? American Journal of Clinical Nutrition 1988;47:352-356.

15.Jeevanandam M, Petersen SR, Shamos RF. Protein and glucose fuel kinetics and hormonal changes in elderly trauma patients. Metabolism 1993;42:1255-1262.

16.Campbell AJ, Buchner DM. Unstable disability and the fluctuations of fragility . Age and ageing 1997;26:315-318.

17.Rudman D. Protein calorie undernutrition in the nursing home . Journal of the American Geriatrics Society 1989;37:173-183.

18.Lesourd BM. Nutrition and immunity in elderly ; modification of immune responses with nutritional treatments . American Journal of Clinical Nutrition 1997;66:478S -484S.

19.Sullivan D, Lipschitz D. Evaluating and treating nutritional problems in older patients. Clinics in Geriatric Medicine 1997;13:753-768.

20.Felgines C, Svanovitch C, Farges M-C, etal. Protein metabolism in rats during long term dietary restriction: Influence of ageing. Journal of Parenteral and Enteral Nutrition 1999;23:32-37.

21.Svanovitch C, Felgines C, Farges M-C, etal. Severe dietary restriction initiated in aged rats: evidence of poor adaptation in terms of protein metabolism and intestinal functions. European Journal of Clinical Investigation 1999;29:504-511.

22.Castenanda C, Charnley JM, Evans WJ, Crim MC. Protein turn over and energy metabolism of elderly women fed a low protein diet. American Journal of Clinical Nutrition 1995;62:40-48.

23.Castenanda C, Charnley JM, Evans WJ, Crim MC. Elderly women accomodate to a low protein diet with losses of body cell mass, muscle function and immune function. American Journal of Clinical Nutrition 1995;62:30-39.

24.Lesourd B. Protein undernutrition as the major cause of decreased immune function in the elderly; clinical and functional implications. Nutrition Reviews 1995;53:S86-S91.

25.Pillaud E, Bories P-N, Le Parco J-C, Campillo B. Nutritional status and energy expenditure in elderly patients with recent hip fracture during a 2 month follow up. British Journal of Nutrition 2000:83:97-103.

26.Hedstrom M, Saaf M, Dalen N. Low IGF-1 levels in hip fracture patients ; A comparison of 20 coxarthrotic and 23 hip fracture patients. Acta Orthopaedica Scandinavian 1999;70:145-148.

27.Nelson KM, Richards EW, Long CL, etal. Protein and energy balance following femoral neck fractures in geriatric patients. Metabolism 1995;44:59-66.

28.Campillo B Pillaud E, Bories PN, etal. Serum levels of IGF-1 in the 3 months following surgery for a hip fracture in elderly ; relationship with nutritional status and inflammatory reaction. Clinical Nutrition 2000;19:349-354.

29.Bonjour JP, Schurch MA, Rizolli R. Nutritional aspects of hip fractures . Bone 1996;18:139S-144S.

30.Older MWJ, Edwards D, Dickerson JWT. A nutrient survey in elderly women with femoral neck fractures. British journal of surgery 1980;67:884-886.

31.Patterson BM, Cornell CN, Carbone B, Levine B, Chapman B. Protein depletion and metabolic stress in elderly patients who have a fracture of the hip. JBJS 1992 ;74A:251-260.

32.Karlsson M, Nilsson JA, Sernbo I, Redlund JI, Johnell O,Obrant KJ. Changes of bone mineral mass and soft tissue composition after hip fracture . Bone 1996;18:19-22.

33.Chandra RK, Kumari S. Nutrition and immunity; an overview. Journal of Nutrition 1994; 124:1433S-1435S.

34.Chandra R. Nutrition and immunity in elderly; clinical significance . Nutrition Reviews 1995;53:S80-S83.

35.Jeejeebhoy KN. How should we monitor nutritional support : structure or function? New horizons 1994;2:131-138.

36.Jeejeebhoy KN, Detsky AS, Baker JP. Assessment of the nutritional status. The Journal of Parenteral and Enteral Nutrition 1990;14:193S-196S.

37.Rasmussen HH, Kondrup J, Staun M, Ladefoged K, Kristensen H, Wengler A. Prevalence of patients at nutritional risk in Danish hospitals. Clin Nutr. 2004 Oct;23(5):1009-15.

38.Bruun LI, Bosaeus I, Bergstad I, Nygaard K. Prevalence of malnutrition in surgical patients : evaluation of nutritional support and documentation**.** Clin Nutr 1999 Jun;18(3):141-7.

39.Jebb SA . Incidence and recognition of malnutrition in hospital .Clin Nutr 1994 Aug;13(4):267-8.

40.Jensen JE, Jensen TG, Smith TK, Johnston DA, Dudrick SJ. Nutrition in orthopaedic surgery. J Bone Joint Surg Am. 1982 Dec;64(9):1263-72.

41.McWhirter JP, Pennington CR .Incidence and recognition of malnutrition in hospital**.** BMJ. 1994 Apr ;308(6934):945-8.

42.Nematy M, Hickson M, Brynes AE, Ruxton CH, Frost GS. Vulnerable patients with a fractured neck of femur: nutitional status and support in hospital**.** J Hum Nutr Diet. 2006 Jun;19(3):209-18.

43.Van Hoang H, Silverstone FA, Leventer S, Wolf-Klein GP, Foley CJ.The effect of nutitional status on length of stay in elderly hip fracture patients. J Nutr Health Aging 1998;2(3):159-61.

44.Hanger HC, Smart EJ, Merrilees MJ, Frampton CM.
The prevalence of malnutrition in elderly hip fracture patients. N Z Med J. 1999 Mar 26;112(1084):88-90.

45.Symeonidis PD, Clark D . Assessment of malnutrition in hip fracture patients : effects of surgical delay, hospital stay and mortality. Acta Orthop Belg. 2006 Aug;72(4):420-7.

46.Michels KB, Greenland S, Rosner BA. Does BMI adequately capture the relation of the body composition and body size to health outcome ? American Journal of epidemiology 1998;147:167-172.

47.Grant JP, Custer PB, Thurlow J. Current techniques of nutritional assessment. Surgical Clinics of North America 1981;61:437-463.

48.Charles W. Bishop, Phyllis E. Bowe , and S. J. Ritchey. Norms for nutritional assessment of American adults by upper arm anthropometry. The American Journal of Clinical Nutrition 34; November 1981: 2530-2539.

49.Karyadi et al. Journal of Nutrition.130 (12): 2953. 2000 .

50.Dreblow DM, Anderson CF, Moxness K . Nutritional assessment of orthopaedic patients. Mayo Clin Proc.1981 Jan;56(1):51-4.

51.Del Savio GC, Zelicof SB, Wexler LM, Byrne DW, Reddy PD, Fish D, Ende KA. Preoperative nutritional status and outcome of elective total hip replacement**.** Clin Orthop Relat Res. 1996 May;(326):153-61.

52.Gherini S, Vaughn BK, Lombardi AV Jr, Mallory TH.
Delayed wound healing and nutritional deficiencies after total hip arthroplasty **.** Clin Orthop Relat Res. 1993 Aug;(293):188-95.

53.Raf J Van Hoeyweghen, Ivo H De Leeuw, and Maurits FJ Vandewoude. Creatinine arm index as alternative for creatinine height index .Am J Clin Nuir 1992;56:61 1-5.

54.Rainey-Macdonald CG, Holliday RL, et al. Validity of a two-variable nutritional index for use in selecting candidates for nutritional support. J Parenteral Enteral Nutrition (JPEN). 1983; 7: 15-20.

55.Murphy MC, Brooks CN, New SA, Lumbers ML.
The use of the Mini-Nutritional Assessment (MNA) tool in elderly orthopaedic patients**.** Eur J Clin Nutr. 2000 Jul;54(7):555-62.

56.M Shirodkar, K M Mohandas. Subjective global assessment: a simple and reliable screening tool for malnutrition among Indians. Indian J Gastroenterol 2005;24:246-250.

57.Barbosa silva MC, Barros AJ . Indications and limitations of the use of SGA in clinical practice ; an update . Curr Opin Clin Nutr Metab Care. 2006 May;9(3):263-9.

58.Gordon S. Sacks , Kaye Dearman , William H. Replogl , Virginia L. Cora , Mark Meeks, and Todd Canada . Use of Subjective Global Assessment to Identify Nutrition-Associated Complications and Death in Geriatric Long-Term Care Facility Residents . Journal of the American College of Nutrition, Vol. 19, No. 5, 570-577 (2000).

59.Deurenberg P. Limitations of the bioelectrical impedence method for the assessment of body fat in severe obesity . American Journal of Clinical Nutrition 1996;64:449S-52S.

60.Heymsfield SB, Wang Z, Visser M, Gallagher D, Pierson Jr RN . Techniques used in the measurement of body composition ; an overview with emphasis on BIA. American Journal of Clinical Nutrition 1996;64 (sup):478S-84S.

61.Briet F, Twomey C, Jeejeebhoy KN . Refeeding increases the mitochondrial complex activity in malnourished patients , evidence for a sensitive nutritional marker. Gasteroenterology 1999;116:A541.

62.Pratt WB, Veitch JM, McRoberts RL. Nutritional status of orthopaedic patients with surgical complications. Clin Orthop Relat Res.1981 Mar-Apr;(155):81-4.

63.Jensen JE, Jensen TG, Smith TK, Johnston DA, Dudrick SJ. Nutrition in orthopaedic surgery**.** J Bone Joint Surg Am.1982 Dec;64(9):1263-72.

64.Smith TK . Prevention of complications in orthopaedic surgery secondary to nutritional depletion. Clin Orthop Relat Res. 1987 Sep;(222):91-7.

65.Zorrilla P, Salido JA, Lopez-Alonso A, Silva A. Serum zinc as a prognostic tool for wound healing in hip hemiarthroplasty. Clin Orthop Relat Res. 2004 Mar;(420):304-8.

66.Puskarich CL, Nelson CL, Nusbickel FR, Stroope HF.
The use of two nutritional indicators in identifying long bone fracture patients who do and do not develop infections. J Orthop Res.1990 Nov;8(6):799-803.

67.Guo JJ, Yang H, Qian H, Huang L, Guo Z, Tang T.
The Effects of Different Nutritional Measurements on Delayed Wound Healing After Hip Fracture in the Elderly**.** J Surg Res. 2008 Oct 16.

68.Lawson RM, Doshi MK, Barton JR, Cobden I .The effect of unselected post-operative nutritional supplementation on nutritional status and clinical outcome of orthopaedic patients**.** Clin Nutr.2003 Feb;22(1):39-46.

69.National Nosocomial Infections Surveillance (NNIS) System: NNIS report, data summary from January 1992 to June 2002, issued August 2002. Am J Infect Control 2002 Dec; 30(8): 458-75 .

70.Robert Slappendel, Ris Dirksen, Eric W G Weber and Dick B van der Schaaf .An algorithm to reduce allogenic red blood cell transfusions for major orthopedic surgery. Acta Orthop Scand 2003; 74 (5): 569–575.

71.Gary E. Raskob and Jack Hirsh. Controversies in Timing of the First Dose of Anticoagulant Prophylaxis Against Venous Thromboembolism After Major Orthopedic Surgery .CHEST 2003; 124:379S–385S.

Proforma

Name :
Age :
Sex :
Hosp.No:
Occupation:
Address :

Diagnosis:

Surgery done :

Comorbidities :

Type of anaesthesia :
Duration of surgery :
Duration of anaesthesia:
Total blood loss:
Transfusions:

Anthropometry:

	At adm	At dis	3m	6m
BMI				
MUAC				
TSF				

Hematology

	At adm	At dis	3m	6m
PCV				
TLC				
Alb				
Pre alb				
Transferrin				

Informed Consent

i) I confirm that I have read and understood the information sheet dated _____ for the above study and have had the opportunity to ask questions.

(ii) I understand that my participation in the study is voluntary and that I am

free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.

(iii) I understand that the Sponsor of the clinical trial, others working on the Sponsor's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published.

(iv) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s)

(v) I agree to take part in the above study.

Consent taken by -

patient/guardian

witness

ANNEXURE

Tables for analysis of prealbumin in PLIF group

Table - 1

(I) PA	(J) PA	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	3.364*	.178	.000	2.913	3.815
	3	.667*	.135	.000	.325	1.009
2	1	-3.364*	.178	.000	-3.815	-2.913
	3	-2.697*	.127	.000	-3.017	-2.377
3	1	-.667*	.135	.000	-1.009	-.325
	2	2.697*	.127	.000	2.377	3.017

Table - 2

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	31783.440	1	31783.440	1.838E3	.000
age_rec	163.198	1	163.198	9.439	.004
Error	535.974	31	17.289		

Tables for analysis of prealbumin in PLIF group

Table - 3

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	65164.070	1	65164.070	2.890E3	.000
gender	.070	1	.070	.003	.956
Error	699.102	31	22.552		

Table - 4

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	45645.655	1	45645.655	2.987E3	.000
DM	225.493	1	225.493	14.757	.001
Error	473.678	31	15.280		

Tables for analysis of prealbumin in PLIF group

Table - 5

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	27838.245	1	27838.245	1.244E3	.000
HT	5.356	1	5.356	.239	.628
Error	693.816	31	22.381		

Table - 6

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	20092.525	1	20092.525	987.287	.000
woundinf	68.283	1	68.283	3.355	.077
Error	630.889	31	20.351		

Tables for analysis of transferrin in PLIF group

Table - 7

(I) TF	(J) TF	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	23.485*	1.823	.000	18.880	28.090
	3	3.303*	1.084	.014	.564	6.042
2	1	-23.485*	1.823	.000	-28.090	-18.880
	3	-20.182*	1.452	.000	-23.851	-16.513
3	1	-3.303*	1.084	.014	-6.042	-.564
	2	20.182*	1.452	.000	16.513	23.851

Table - 8

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	3390385.092	1	3390385.092	1.887E3	.000
age_rec	12909.698	1	12909.698	7.185	.012
Error	55700.322	31	1796.785		

Tables for analysis of transferrin in PLIF group

Table - 9

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	7068118.968	1	7068118.968	3.194E3	.000
gender	18.927	1	18.927	.009	.927
Error	68591.093	31	2212.616		

Table - 10

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	4938701.680	1	4938701.680	3.559E3	.000
DM	25586.367	1	25586.367	18.436	.000
Error	43023.653	31	1387.860		

Tables for analysis of transferrin in PLIF group

Table - 11

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	3025347.965	1	3025347.965	1.376E3	.000
HT	438.874	1	438.874	.200	.658
Error	68171.147	31	2199.069		

Table - 12

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2150496.849	1	2150496.849	1.127E3	.000
woundinf	9464.365	1	9464.365	4.961	.033
Error	59145.656	31	1907.924		

Tables for analysis of prealbumin in Infective Spondylitis group

Table - 13

(I) PA	(J) PA	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	3.167*	.232	.000	2.550	3.783
	3	.500	.271	.248	-.220	1.220
2	1	-3.167*	.232	.000	-3.783	-2.550
	3	-2.667*	.243	.000	-3.311	-2.023
3	1	-.500	.271	.248	-1.220	.220
	2	2.667*	.243	.000	2.023	3.311

Table - 14

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	29541.339	1	29541.339	1.195E3	.000
age_rec	32.747	1	32.747	1.325	.267
Error	395.420	16	24.714		

Tables for analysis of prealbumin in Infective Spondylitis group

Table - 15

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	25200.577	1	25200.577	942.982	.000
gender	.577	1	.577	.022	.885
Error	427.590	16	26.724		

Table - 16

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	21642.890	1	21642.890	810.591	.000
DM	.964	1	.964	.036	.852
Error	427.202	16	26.700		

Tables for analysis of prealbumin in Infective Spondylitis group

Table - 17

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	16598.848	1	16598.848	663.733	.000
HT	28.033	1	28.033	1.121	.305
Error	400.133	16	25.008		

Table - 18

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	30912.300	1	30912.300	1.262E3	.000
UTI	36.300	1	36.300	1.482	.241
Error	391.867	16	24.492		

Tables for analysis of prealbumin in Infective Spondylitis group

Table -19

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	11213.891	1	11213.891	479.765	.000
woundinf	54.188	1	54.188	2.318	.147
Error	373.979	16	23.374		

Tables for analysis of transferrin in Infective Spondylitis group

Table - 20

(I) TF	(J) TF	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	22.056*	1.697	.000	17.551	26.560
	3	4.444*	1.469	.023	.544	8.345
2	1	-22.056*	1.697	.000	-26.560	-17.551
	3	-17.611*	2.144	.000	-23.303	-11.919
3	1	-4.444*	1.469	.023	-8.345	-.544
	2	17.611*	2.144	.000	11.919	23.303

Table - 21

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	3494964.262	1	3494964.262	5.187E3	.000
age_rec	220.262	1	220.262	.327	.575
Error	10779.905	16	673.744		

Tables for analysis of transferring in Infective spondylitis group.

Table - 22

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2928351.193	1	2928351.193	4.441E3	.000
gender	450.156	1	450.156	.683	.421
Error	10550.010	16	659.376		

Table - 23

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2607619.048	1	2607619.048	4.178E3	.000
DM	1015.048	1	1015.048	1.626	.220
Error	9985.119	16	624.070		

Tables for analysis of transferring in Infective spondylitis group

Table - 24

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2036849.633	1	2036849.633	2.975E3	.000
HT	45.633	1	45.633	.067	.800
Error	10954.533	16	684.658		

Table - 25

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	3639502.801	1	3639502.801	5.347E3	.000
UTI	110.208	1	110.208	.162	.693
Error	10889.958	16	680.622		

Tables for analysis of transferring in Infective spondylitis group

Table - 26

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1480167.521	1	1480167.521	2.181E3	.000
woundinf	143.521	1	143.521	.212	.652
Error	10856.646	16	678.540		

Tables for comparison between PLIF group and Infective Spondylitis group

Table - 27

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	87794.675	1	87794.675	3.816E3	.000
Group	112.322	1	112.322	4.882	.032
Error	1127.338	49	23.007		

Table - 28

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	9875864.728	1	9875864.728	6.079E3	.000
Group	2745.120	1	2745.120	1.690	.200
Error	79610.187	49	1624.698		

Tables for analysis of prealbumin in Unilateral replacement group

Table - 29

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	80811.700	1	80811.700	4.368E3	.000
age_rec	376.917	1	376.917	20.373	.000
Error	814.017	44	18.500		

Tables for analysis of prealbumin in Unilateral replacement group

Table – 30

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	101632.664	1	101632.664	3.762E3	.000
gender	2.230	1	2.230	.083	.775
Error	1188.705	44	27.016		

Table – 31

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	44188.452	1	44188.452	1.736E3	.000
DM	71.235	1	71.235	2.799	.101
Error	1119.700	44	25.448		

Tables for analysis of prealbumin in Unilateral replacement group

Table – 32

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	56626.325	1	56626.325	2.232E3	.000
HT	74.847	1	74.847	2.951	.093
Error	1116.088	44	25.366		

Table – 33

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	56905.502	1	56905.502	2.214E3	.000
woundinf	60.110	1	60.110	2.339	.133
Error	1130.825	44	25.701		

Tables for analysis of transferrin in Unilateral replacement group

Table – 34

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	8003781.875	1	8003781.875	4.847E3	.000
age_rec	24386.223	1	24386.223	14.767	.000
Error	72662.277	44	1651.415		

Tables for analysis of transferrin in Unilateral replacement group

Table – 35

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1.020E7	1	1.020E7	4.623E3	.000
gender	.472	1	.472	.000	.988
Error	97048.028	44	2205.637		

Table – 36

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	4506460.132	1	4506460.132	2.130E3	.000
DM	3961.175	1	3961.175	1.872	.178
Error	93087.325	44	2115.621		

Tables for analysis of transferrin in Unilateral replacement group

Table – 37

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	5714800.953	1	5714800.953	2.765E3	.000
HT	6108.316	1	6108.316	2.955	.093
Error	90940.184	44	2066.822		

Table – 38

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	5730918.881	1	5730918.881	2.749E3	.000
woundinf	5327.577	1	5327.577	2.556	.117
Error	91720.923	44	2084.566		

Tables for analysis of prealbumin in bilateral replacement group

Table – 39

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	7501.356	1	7501.356	614.226	.000
age_rec	2.939	1	2.939	.241	.631
Error	170.978	14	12.213		

Tables for analysis of prealbumin in bilateral replacement group

Table – 40

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	28905.339	1	28905.339	2.336E3	.000
gender	.672	1	.672	.054	.819
Error	173.244	14	12.375		

Table – 41

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	17380.137	1	17380.137	2.453E3	.000
DM	74.720	1	74.720	10.546	.006
Error	99.197	14	7.085		

Tables for analysis of prealbumin in biilateral replacement group

Table – 42

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	22750.694	1	22750.694	1.920E3	.000
HT	8.028	1	8.028	.677	.424
Error	165.889	14	11.849		

Table – 43

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	14040.429	1	14040.429	1.190E3	.000
woundinf	8.679	1	8.679	.735	.406
Error	165.238	14	11.803		

Tables for analysis of transferrin in Bilateral replacement group

Table – 44

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	757123.756	1	757123.756	450.645	.000
age_rec	22.756	1	22.756	.014	.909
Error	23521.244	14	1680.089		

Tables for analysis of transferrin in Bilateral replacement group

Table – 45

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	3037841.422	1	3037841.422	1.847E3	.000
gender	513.422	1	513.422	.312	.585
Error	23030.578	14	1645.041		

Table – 46

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1879480.692	1	1879480.692	1.337E3	.000
DM	3859.692	1	3859.692	2.745	.120
Error	19684.308	14	1406.022		

Tables for analysis of transferrin in Bilateral replacement group

Table – 47

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2416988.444	1	2416988.444	1.459E3	.000
HT	348.444	1	348.444	.210	.654
Error	23195.556	14	1656.825		

Table – 48

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1498137.190	1	1498137.190	953.311	.000
woundinf	1542.857	1	1542.857	.982	.339
Error	22001.143	14	1571.510		

Tables for comparison between Unilateral and Bilateral replacement groups

Table – 49

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	99020.272	1	99020.272	4.353E3	.000
Group	139.627	1	139.627	6.138	.016
Error	1364.851	60	22.748		

Table – 50

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1.019E7	1	1.019E7	5.068E3	.000
Group	6490.452	1	6490.452	3.229	.077
Error	120592.500	60	2009.875		

Tables for analysis of prealbumin in Unilateral TKR

Table – 51

(I) PA	(J) PA	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	3.800*	.243	.000	3.140	4.460
	3	.867*	.165	.000	.418	1.316
2	1	-3.800*	.243	.000	-4.460	-3.140
	3	-2.933*	.284	.000	-3.705	-2.162
3	1	-.867*	.165	.000	-1.316	-.418
	2	2.933*	.284	.000	2.162	3.705

Table – 52

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	7936.025	1	7936.025	332.495	.000
age_rec	.025	1	.025	.001	.974
Error	310.286	13	23.868		

Tables for analysis of prealbumin in Unilateral TKR

Table – 53

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	30379.615	1	30379.615	1.288E3	.000
Gender	3.793	1	3.793	.161	.695
Error	306.519	13	23.578		

Table – 54

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	24080.316	1	24080.316	1.112E3	.000
DM	28.849	1	28.849	1.332	.269
Error	281.462	13	21.651		

Tables for analysis of prealbumin in Unilateral TKR

Table – 55

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	20844.272	1	20844.272	897.683	.000
HT	8.450	1	8.450	.364	.557
Error	301.861	13	23.220		

Table – 56

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	19950.139	1	19950.139	850.411	.000
woundinf	5.339	1	5.339	.228	.641
Error	304.972	13	23.459		

Tables for analysis of transferrin in Unilateral TKR group

Table – 57

(I) TF	(J) TF	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	32.909*	4.111	.000	21.111	44.708
	3	6.000*	2.036	.044	.156	11.844
2	1	-32.909*	4.111	.000	-44.708	-21.111
	3	-26.909*	3.701	.000	-37.532	-16.286
3	1	-6.000*	2.036	.044	-11.844	-.156
	2	26.909*	3.701	.000	16.286	37.532

Table – 58

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	809869.435	1	809869.435	410.559	.000
age_rec	13.435	1	13.435	.007	.935
Error	25643.810	13	1972.601		

Tables for analysis of transferrin in Unilateral TKR

Table – 59

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	3092942.237	1	3092942.237	1.577E3	.000
Gender	157.170	1	157.170	.080	.782
Error	25500.074	13	1961.544		

Table – 60

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2489760.073	1	2489760.073	1.294E3	.000
DM	647.184	1	647.184	.336	.572
Error	25010.061	13	1923.851		

Tables for analysis of transferrin in Unilateral TKR

Table – 61

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2127693.889	1	2127693.889	1.130E3	.000
HT	1185.800	1	1185.800	.630	.442
Error	24471.444	13	1882.419		

Table – 62

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2016971.756	1	2016971.756	1.058E3	.000
woundinf	880.022	1	880.022	.462	.509
Error	24777.222	13	1905.940		

Tables for analysis of prealbumin in Bilateral TKR group

Table – 63

(I) PA	(J) PA	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	3.545*	.282	.000	2.737	4.354
	3	.455	.207	.159	-.140	1.050
2	1	-3.545*	.282	.000	-4.354	-2.737
	3	-3.091*	.211	.000	-3.697	-2.485
3	1	-.455	.207	.159	-1.050	.140
	2	3.091*	.211	.000	2.485	3.697

Table – 64

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	7130.776	1	7130.776	546.342	.000
age_rec	6.412	1	6.412	.491	.501
Error	117.467	9	13.052		

Tables for analysis of prealbumin in Bilateral TKR group

Table – 65

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	11858.108	1	11858.108	908.997	.000
gender	6.471	1	6.471	.496	.499
Error	117.407	9	13.045		

Table – 66

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	15414.187	1	15414.187	2.100E3	.000
DM	57.823	1	57.823	7.878	.020
Error	66.056	9	7.340		

Tables for analysis of prealbumin in Bilateral TKR group

Table – 67

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	15858.505	1	15858.505	1.295E3	.000
HT	13.657	1	13.657	1.115	.318
Error	110.222	9	12.247		

Table – 68

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	6718.548	1	6718.548	489.083	.000
woundinf	.245	1	.245	.018	.897
Error	123.633	9	13.737		

Table for analysis of transferrin in bilateral TKR group

Table – 69

(I) TF	(J) TF	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	32.909*	4.111	.000	21.111	44.708
	3	6.000*	2.036	.044	.156	11.844
2	1	-32.909*	4.111	.000	-44.708	-21.111
	3	-26.909*	3.701	.000	-37.532	-16.286
3	1	-6.000*	2.036	.044	-11.844	-.156
	2	26.909*	3.701	.000	16.286	37.532

Table – 70

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	720908.412	1	720908.412	332.531	.000
age_rec	9.503	1	9.503	.004	.949
Error	19511.467	9	2167.941		

Table for analysis of transferrin in bilateral TKR group

Table – 71

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1226909.118	1	1226909.118	628.402	.000
gender	1949.118	1	1949.118	.998	.344
Error	17571.852	9	1952.428		

Table – 72

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1660451.636	1	1660451.636	879.615	.000
DM	2531.636	1	2531.636	1.341	.277
Error	16989.333	9	1887.704		

Table for analysis of transferrin in bilateral TKR group

Table – 73

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1703771.157	1	1703771.157	792.996	.000
HT	184.247	1	184.247	.086	.776
Error	19336.722	9	2148.525		

Table – 74

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	722592.012	1	722592.012	333.461	.000
woundinf	18.436	1	18.436	.009	.929
Error	19502.533	9	2166.948		

Tables for comparison between Unilateral and Bilateral TKR groups

Table – 75

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	50528.438	1	50528.438	2.793E3	.000
Group	51.105	1	51.105	2.825	.106
Error	434.190	24	18.091		

Table – 76

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	5232665.273	1	5232665.273	2.780E3	.000
Group	2585.068	1	2585.068	1.373	.253
Error	45178.214	24	1882.426		

Tables for analysis of prealbumin in unilateral THR group

Table – 77

(I) PA	(J) PA	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	3.548*	.190	.000	3.066	4.031
	3	1.032*	.118	.000	.733	1.332
2	1	-3.548*	.190	.000	-4.031	-3.066
	3	-2.516*	.179	.000	-2.970	-2.063
3	1	-1.032*	.118	.000	-1.332	-.733
	2	2.516*	.179	.000	2.063	2.970

Table – 78

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	66028.065	1	66028.065	4.175E3	.000
age_rec	381.613	1	381.613	24.128	.000
Error	458.667	29	15.816		

Tables for analysis of prealbumin in unilateral THR group

Table – 79

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	65841.164	1	65841.164	2.287E3	.000
gender	5.551	1	5.551	.193	.664
Error	834.729	29	28.784		

Table – 80

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	16276.770	1	16276.770	574.900	.000
DM	19.222	1	19.222	.679	.417
Error	821.057	29	28.312		

Tables for analysis of prealbumin in unilateral THR group

Table – 81

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	35393.763	1	35393.763	1.510E3	.000
HT	160.731	1	160.731	6.859	.014
Error	679.549	29	23.433		

Table – 82

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	36699.098	1	36699.098	1.360E3	.000
woundinf	57.808	1	57.808	2.142	.154
Error	782.472	29	26.982		

Tables for analysis of transferrin in Unilateral THR group

Table – 83

(I) TF	(J) TF	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	35.226*	1.918	.000	30.362	40.090
	3	11.581*	1.760	.000	7.119	16.043
2	1	-35.226*	1.918	.000	-40.090	-30.362
	3	-23.645*	1.786	.000	-28.173	-19.117
3	1	-11.581*	1.760	.000	-16.043	-7.119
	2	23.645*	1.786	.000	19.117	28.173

Table – 84

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	6525440.865	1	6525440.865	4.265E3	.000
age_rec	24445.597	1	24445.597	15.978	.000
Error	44369.651	29	1529.988		

Tables for analysis of transferrin in Unilateral THR group

Table – 85

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	6549969.205	1	6549969.205	2.761E3	.000
gender	25.549	1	25.549	.011	.918
Error	68789.698	29	2372.059		

Table – 86

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1613671.416	1	1613671.416	705.031	.000
DM	2440.190	1	2440.190	1.066	.310
Error	66375.057	29	2288.795		

Tables for analysis of transferrin in Unilateral THR group

Table – 87

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	3550095.279	1	3550095.279	1.901E3	.000
HT	14668.527	1	14668.527	7.856	.009
Error	54146.721	29	1867.128		

Table – 88

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	3691825.296	1	3691825.296	1.661E3	.000
woundinf	4374.027	1	4374.027	1.968	.171
Error	64441.221	29	2222.111		

Tables for comparison between Unilateral THR and TKR groups

Table – 89

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	9011824.298	1	9011824.298	4.197E3	.000
Group	2576.008	1	2576.008	1.200	.279
Error	94472.492	44	2147.102		

Table – 90

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	89445.677	1	89445.677	3.421E3	.000
Group	40.344	1	40.344	1.543	.221
Error	1150.591	44	26.150		

BMI association in PLIF group

Table -91

wound inf * BMI_Categorised

			BMI_Categorised			Total
			< 20	Between 20 to 25	> 25	
wound inf	No	Count	3	29	27	59
		% within wound inf	5.1%	49.2%	45.8%	100.0%
	Yes	Count	0	4	1	5
		% within wound inf	.0%	80.0%	20.0%	100.0%
Total		Count	3	33	28	64
		% within wound inf	4.7%	51.6%	43.8%	100.0%

Table -92

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	1.804[a]	2	.406	.503		
Likelihood Ratio	2.089	2	.352	.424		
Fisher's Exact Test	1.608			.503		
Linear-by-Linear Association	.585[b]	1	.444	.687	.351	.230
N of Valid Cases	64					

BMI association in Infective Spondylitis group

Table -93

UTI * BMI_Categorised

			BMI_Categorised		
			< 20	Between 20 to 25	Total
UTI	No	Count	1	15	16
		% within UTI	6.2%	93.8%	100.0%
	Yes	Count	3	9	12
		% within UTI	25.0%	75.0%	100.0%
Total		Count	4	24	28
		% within UTI	14.3%	85.7%	100.0%

Table -94

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	1.969[a]	1	.161	.285	.196	
Continuity Correction[b]	.735	1	.391			
Likelihood Ratio	1.989	1	.158	.285	.196	
Fisher's Exact Test				.285	.196	
Linear-by-Linear Association	1.898[c]	1	.168	.285	.196	.172
N of Valid Cases	28					

BMI association in Infective Spondylitis group

Table -95

wound inf * BMI_Categorised

			BMI_Categorised		
			< 20	Between 20 to 25	Total
wound inf	No	Count	2	22	24
		% within wound inf	8.3%	91.7%	100.0%
	Yes	Count	2	2	4
		% within wound inf	50.0%	50.0%	100.0%
Total		Count	4	24	28
		% within wound inf	14.3%	85.7%	100.0%

Table -96

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	4.861[a]	1	.027	.086	.086	
Continuity Correction[b]	2.054	1	.152			
Likelihood Ratio	3.653	1	.056	.086	.086	
Fisher's Exact Test				.086	.086	
Linear-by-Linear Association	4.688[c]	1	.030	.086	.086	.081
N of Valid Cases	28					

BMI association in Unilateral TKR group

Table -97

wound inf * BMI_categorised

			BMI_categorised		
			Between 20 to 25	>25	Total
wound inf	No	Count	29	16	45
		% within wound inf	64.4%	35.6%	100.0%
	Yes	Count	3	2	5
		% within wound inf	60.0%	40.0%	100.0%
Total		Count	32	18	50
		% within wound inf	64.0%	36.0%	100.0%

Table -98

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.039[a]	1	.844	1.000	.599	
Continuity Correction[b]	.000	1	1.000			
Likelihood Ratio	.038	1	.845	1.000	.599	
Fisher's Exact Test				1.000	.599	
Linear-by-Linear Association	.038[c]	1	.846	1.000	.599	.358
N of Valid Cases	50					

BMI association in Bilateral TKR group

Table -99

UTI * BMI_categorised

			BMI_categorised		
			Between 20 to 25	> 25	Total
UTI	No	Count	9	16	25
		% within UTI	36.0%	64.0%	100.0%
	Yes	Count	1	0	1
		% within UTI	100.0%	.0%	100.0%
Total		Count	10	16	26
		% within UTI	38.5%	61.5%	100.0%

Table -100

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	1.664[a]	1	.197	.385	.385	
Continuity Correction[b]	.058	1	.809			
Likelihood Ratio	1.976	1	.160	.385	.385	
Fisher's Exact Test				.385	.385	
Linear-by-Linear Association	1.600[c]	1	.206	.385	.385	.385
N of Valid Cases	26					

BMI association in Bilateral TKR group

Table -101

wound inf * BMI_categorised

			BMI_categorised		
			Between 20 to 25	> 25	Total
wound inf	No	Count	10	13	23
		% within wound inf	43.5%	56.5%	100.0%
	Yes	Count	0	3	3
		% within wound inf	.0%	100.0%	100.0%
Total		Count	10	16	26
		% within wound inf	38.5%	61.5%	100.0%

Table -102

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	2.120[a]	1	.145	.262	.215	
Continuity Correction[b]	.681	1	.409			
Likelihood Ratio	3.154	1	.076	.262	.215	
Fisher's Exact Test				.262	.215	
Linear-by-Linear Association	2.038[c]	1	.153	.262	.215	.215
N of Valid Cases	26					

BMI association in Unilateral THR group

Table -103

wound inf * BMI_categorised

			BMI_categorised		
			Between 20 to 25	>25	Total
wound inf	No	Count	29	16	45
		% within wound inf	64.4%	35.6%	100.0%
	Yes	Count	3	2	5
		% within wound inf	60.0%	40.0%	100.0%
Total		Count	32	18	50
		% within wound inf	64.0%	36.0%	100.0%

Table -104

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.039[a]	1	.844	1.000	.599	
Continuity Correction[b]	.000	1	1.000			
Likelihood Ratio	.038	1	.845	1.000	.599	
Fisher's Exact Test				1.000	.599	
Linear-by-Linear Association	.038[c]	1	.846	1.000	.599	.358
N of Valid Cases	50					