Chapter VI

DISCUSSION

6.1 Biochemical parameters in Blood :-

Nephrolithiasis is a common disorder in developing countries like India. Several factors are responsible for developing kidney stones such as inadequate fluid intake, high urinary levels of calcium, oxalate, uric acid and low urinary levels of citrate, magnesium etc (Loris Borghi et al., 1996; R. Kumar et al., 2003).

The nutritional factors also play a vital role in the formation of renal calculi. The high intake of dietary sodium, fats, animal proteins, refined sugars and low intake of dietary fibers are the risk factors for the renal stone formation. The levels of various components in the blood or serum are reflected by dietary intake (Nayer et al., 1997).

6.1.1 Non protein nitrogenous substances in the blood :-

In the present study non-protein nitrogenous substances such as urea, creatinine and uric acid levels were estimated in nephrolithiasis patients and normal healthy controls. No significant change (P>0.05) was observed in serum creatinine and urea levels in patients of nephrolithiasis as compared to normal healthy controls (Table No. 3). Our results are comparable with Loris Borghi et al., 2002 and Takashi Yagsava et al., 2000. As urea levels are affected
by high dietary proteins whereas creatinine levels depends on body muscle mass and renal function.

In the present study values of serum creatinine and urea indicate that there is no abnormalities in kidney function and no obstruction in renal system. Paryani JP et al., (2002) and Gupta Metal et al., (1994) reported elevated levels of serum creatinine in urolithiasis patients and levels were improved after surgical intervention, which indicates that increased levels may be due to obstructions.

However in our study the significant rise (P < 0.005) of serum uric acid level’s were observed in nephrolithiasis patients (Table No.3). Smiler results have been reported by previous workers (Nayar D. et al.,1997; P. A.C.Y. Sakhyee et al., 2001; Singh R. K. and Bansal A. 1987)

Increased serum uric acid levels in nephrolithiasis patients may be due to intake of purine rich diet.

6.1.2 Minerals in blood :-

In the present study minerals like calcium, inorganic phosphorus, sodium, potassium, chloride levels were estimated in serum of nephrolithiasis patients and normal healthy controls. Serum calcium and inorganic phosphorous levels were significantly elevated (P < 0.001) in nephrolithiasis patients as compared to normal healthy controls. (Table No. 4 and Figure No. 1).
The increases in levels of serum calcium and inorganic phosphorus in this study are not correlated with previous reports (Nayar D. et al., 1997; Ljunggalls Heidstand H. et al., 1977).

There could be several possibilities of increased serum calcium levels in nephrothiasis patients. One possibility is that there could be high intake of dietary calcium, which leads to the more intestinal absorption of calcium.

The second possibility of increased serum calcium level could be due to increased serum albumin concentration in nephrolithiasis patients. As 40% of total calcium is bound to protein especially albumene. Increased in serum albumin leads to increased of protein bound calcium without change in ionized calcium, which may leads to increase of total calcium level (Flow Chart No. 4).

**Flow Chart No. 4:** Increase of total calcium in response to increased serum albumina.
The third possibility of increased serum calcium in nephrolithiasis patients could be due to hyperparathyroidism. Primary hyperparathyroidism, which is more common in women and older adults, should be considered in patients who have a high normal or elevated serum calcium (10mg/dl) or greater. High normal serum calcium level do not completely rule out this condition, as primary hyperparathyroidism is the intact parathyroid hormone level (Halabe A. and Sutton R. A., 1992). In the present study the serum calcium levels in nephrolithiasis patients were 10.1 ± 0.15 mg/dl, hence the primary hyperthyroidism is ruled out and higher serum calcium level in nephrolithiasis patients may be due to high intake of calcium in diet.

In present study elevated levels of both serum calcium and inorganic phosphorus were observed in nephrolithiasis patients. The reason for such finding may be due to assumption that increased calcium proportionately depresses parathyroid hormone (PTH) activity, which enhances renal phosphorus reabsorption and leads to increased serum inorganic phosphorus levels. One more possibility may be the more exposure to sun light which leads to endogenous vitamin 'D' production with resultant increase in calcium absorption in the gastrointestinal tract. Increase serum calcium leads to increase urinary calcium excretion, which is the major risk factor for renal stone formation.

Ljunghall S. et al., (1977) also reported that there was no inverse relationship between serum calcium and inorganic phosphorus.

In the present study no significant change in the mean levels
of serum sodium, potassium and chloride (P > 0.05) were observed in nephrothiasis patients as compared to normal healthy controls (Table No. 4).

Our results were comparable to previous workers (Okhuwa T. et al., 1988). There were no change in serum sodium, potassium and chloride levels in nephrolithiasis patients, which may indicates that there could not be any acid-base disturbances in nephrolithiasis patients.

6.1.3 Serum Proteins:

In the present study no significant change in serum total protein (P > 0.05) was observed in nephrolithiasis patients as compared to normal healthy controls. However, significantly elevated levels of albumin (P < 0.001) were found in nephrolithiasis.

The reason for non-significant results of serum total protein in patients and controls indicates that nutritional status, synthesis and utilization of protein could have been normal in nephrolithiasis patients.

The significant elevated levels of albumin in nephrolithiasis patients may be due to genetic variation. Ljungall S. et al. (1977) also reported significantly elevated levels of serum albumin in nephrolithiasis patient.

6.2 Urinary Parameters in nephrolithiasis :-

In the present study a number of urinary parameters have been measured in patients suffering from stone disease, is an attempt to correlate altered urinary features with stone formation.
A correct identification of an abnormal excretion of certain compounds for stone formation is considered to be an important aspect of preventive treatment.

6.2.1 Urinary uric acid:

Uric acid has been implicated as inducer of stone formation in calcium oxalate stones by virtue of its ability to induce heterogeneous nucleation. The uric acid is the end product of purine metabolism and excreted in the urine. Animal protein is a major dietary constituent responsible for the relatively high prevalence of stones in populations of developed countries, which is a major dietary source of purines, the precursor of uric acid. Excessive intake of animal protein is therefore associated with hyperuricosuria (Grover P. K. et al., 1990).

In the present study urinary uric acid levels were significantly elevated in nephrolithiasis patients (P < 0.001) as compared to normal healthy controls (Table No. 5, Figure 2-a). Our results were correlated with Pendse A. K. et al., (1984) and Nayer D., Kapil V. Datar et al., (1997).

Thus the association of hyperuricosuria with Calcium oxalate stone has been recognised. The higher excretion of uric acid in nephrolithiasis patients may be influenced by intake of purine rich diet, which is correlated with serum uric acid levels in nephrolithiasis patients.

Solubility of uric acid is affected by pH. As the pH falls below 6.0 to 5.5 the solubility of uric acid decreases and uric acid precipitates
even if hyperuricosuria is not present (Rodman S. S. et al., 1996).

In the present study the urinary pH of stone formers were neither acidic nor alkaline (Table No. 7), thus at the pH 6.10 ± 0.054 the urate may be in dissolved form. The dissolved urate may lower the solubility of Calcium oxalate, and which results in precipitation of calcium oxalate.

The second possibility is that uric acid may crystallize, adsorb and inactivate natural urine inhibitors and hence the stones are developed. In present study heterogeneous nucleation by uric acid were ruled out, as from the analysis of stone pure calcium oxalate stones (78%) were obtained.

The third possibility is that the higher excretion of sodium in nephrolithiasis patients may affects the uric acid excretion by renal mechanism and hence increased excretion of sodium contribute to increase uric acid excretion in nephrolithiasis patients. Thus in present study hyperuricosuria is associated with renal stone formation.

6.2.2. Urinary Oxalate :-

Hyperoxaluria is known to be common risk factor in nephrolithiasis. In the present study significantly higher level (P < 0.001) of urinary oxalate were found in nephrolithiasis patients as compared to normal healthy controls (Table No. 5 and Figure No. 2-a).
Primary hyperoxaluria type I and type II is a rare autosomal recessive disorder caused by deficiencies of enzymes Glyoxalate carboligase and D-Glycerate dehydrogenase respectively, which leads to calcium stone formation in the early childhood (Flowchart No. 2). Oxalate was confirmed as a normal constituent of urine in 1951, but recently the significance of calcium oxalate crystalluria and its relationship to urinary tract stone formation has fully been recognised by Hodkinson A. (1977). Formation of sparingly soluble Calcium oxalate in the urinary tract is considered to be the major factor in urolithiasis (Robertson W. J., and Rutherford A., 1979). Oxalate in urine arises either as an end product of intermediary metabolism or from dietary sources (Hodkinson A. 1977; Gelzayd E. A. et al., 1968).

An increase in excretion of oxalate in nephrolithiasis patients can be attributed to increase in ingestion of oxalate precursors or oxalate rich food. As in the Marathwada region, the people uses more amount of spinach, tomatoes, ground nuts in their diet, thus this may be possibility for the hyperoxaluria in the nephrolithiasis patients.

Higher excretion of oxalate also arises due to the metabolic defects such as primary hyperoxaluria and other gastrointestinal disorders such as bowel disease, ileal resection, biliary diversion, pancreatic insufficiency, spru, small intestinal stasis with bacterial overgrowth and following jejunoileal bypass or resection for the treatment of obesity (Gelzayd E. A., et al., 1968; Earnest D. L. 1979; Smith L. H. et al., 1972; Dickstein S. S. et al., 1973; McDonald G. B.
Primary hyperoxuluria is ruled out in the present study as the present study has been performed in adult patients. And other conditions were ruled out because the patients selected for the study were free from the diseases except nephrolithiasis. Thus the higher excretion of oxalate in the nephrolithiasis patients may be due to increase in endogenous synthesis. It is generally seen in vitamin B₆ deficiency.

Oxalate excretion is influenced by dietary calcium. Inverse relationships between dietary calcium and stone formation have been demonstrated. Men and women with the highest calcium intake have been shown to have nearly one half the rate of stones formation as compared to groups with the lowest intake of calcium (Curhan G. C. et al., 1993; Curhan G. C. et al., 1997).

One explanation for this phenomenon is that dietary calcium binds in the intestinal lumen with dietary oxalate, forming an insoluble, nonabsorbable complex and thus reduces the availability of oxalate in blood circulation and in turn in urinary excretion.

In the present study significantly elevated levels of serum and urinary calcium were observed in nephrolithiasis patients and hence the possibility of less available calcium or low dietary calcium intake in the nephrolithiasis patients were ruled out.
In practice, restriction of dietary calcium suppose to reduced the oxalate excretion, but in present study higher oxalate level indicates the positive correlation between oxalate and calcium excretion.

Earlier it was assumption that intake of tea leads to calcium oxalate stone formation, as tea is the source of oxalate. Our assumption was, the tea and beer should avoid stone formation as both are diuretics, this assumption has been confirmed by the work of Curhan G. C. et al., (1998) who suggested that beverages such as tea or beer, thought to increase urinary oxalate excretion, may protect against stone formation.

The oxalate complexes with calcium to form calcium oxalate salt. The solubility of calcium oxalate salt is affected by changes in the urinary pH. In present study urinary pH of stone formers was 6.1 ± 0.05, which indicates that at this pH calcium oxalate solubility is minimum hence urine get supersaturated with calcium oxalate and crystals of calcium oxalate formation takes place, which leads to formation of renal calculi. Thus restriction of oxalate intake may be useful to reduce urinary oxalate level but not to prevent stone formation.

6.2.3 Urinary citrate:

Human urine inhibits the formation of calcium oxalate monohydrate crystals. The upper limit of metastability for calcium oxalate is higher in urine than in simple salt solution. The urine content inhibits the process of transformation of solution ions into a solid phase (Nucleation). Thus the inhibitors present in urine plays an important role to prevent the stone formation.

Citrate is known to be potent inhibitor at concentrations likely to be present in normal urine. Citrate is freely filtered by renal glomeruli and reabsorbed by proximal tubules.

In the present study urinary citrate levels were significantly reduced by 61.89 % as compared to control group (Table No. 5 and Figure No. 2-c).

Michael J., Nicar et al., (1983), also found low urinary citrate excretion in nephrolithiasis and a specific correlation between citrate and oxalate (increase oxalate and decrease citrate excretion).

In the present study the positive correlation between citrate and uric acid (decreased urinary citrate and increased uric acid) was observed. Earlier investigators also found significantly decreases excretion of citrate in nephrolithiasis patients (Ganter K. Bongartz and Hess A. 1999; Simmi K. Ratan et al., 2002; T. V. R. K. Rao and Sofiya Bano 2003; Michael J. Nicar et al., 1953).
Abraa P. A. *et al.*, and Francois B. *et al.*, in their study, did not find any difference in citrate output among stone formers and normal individuals.

The reduced citrate excretion in nephrolithiasis patients may be due to defects in renal organic acid transport mechanisms. However, in the present study, inverse relation between citrate and calcium was shown and direct proportional relation was shown with magnesium.

The divalent cations such as Ca^{++} and Mg^{++} probably complexing with citrate and inhibiting its reabsorption, thereby increasing citrate excretion through urine. But despite higher calcium excretion in nephrolithiasis patients, the reverse phenomenon was observed in the present study. As calcium excretion was elevated in nephrolithiasis patient, the elevated calcium should inhibit the citrate reabsorption and enhance its excretion in the urine, but this mechanism was hampered in nephrolithiasis patients.

Considering the role of magnesium, the low level of urinary magnesium has been observed in the nephrolithiasis patients. The low concentration of urinary magnesium may not sufficient to form complex with citrate and thereby its reabsorption is affected or increases reabsorption. Hence citrate excretion in urine may be reduced. From these above mechanisms, our assumption is that the magnesium plays a vital role than the calcium in citrate excretion in nephrolithiasis.
The decrease urinary citrate may be due to high intake of protein. The protein causes more acidic urine excretion, to neutralize it, citrate reabsorption is increased and thereby decreases in urinary citrate excretion.

Ganter K Bangartz et al., (1999) reported significant correlation between the concentration of Tomm Harsfall Protein (THP) and citrate in the stone formers and controls. They were found decreased in THP and citrate in calcium oxalate stone formers. This correlation shows that THP concentration is directly proportional to the concentration of citrate. If considering the relationship between citrate and THP, there may be possibility of decrease THP concentration in the urine of stone formers, in the present study.

Thus citrate is interrelated with the THP. Tomm Harsfall Protein (THP) is glycoprotein inhibits aggregation of calcium oxalate crystal (Hess B. Hakagawa et al., 1991). Thus the formation of calcium oxalate crystals takes place due to lower concentration of urinary citrate in the nephrolithiasis patients. Another factor also influence the THP concentration is sodium chloride which increases viscosity of THP and alters the structure of THP and make it to unavailable for interaction with calcium oxalate and also decreases the urinary citrate (Hess B. Hakagawa et al., 1991). In the present study the urinary sodium levels were elevated in the nephrolithiasis patients as compared to controls.
6.2.4 Urinary magnesium :-

On the basis of enormous work done in the past on pathophysiology of idiopathic calcium urolithiasis several urinary risk factors have been established, magnesium is one of the risk factor for calcium urolithiasis.

In the present study, urinary magnesium levels were significantly lower (P < 0.05) in nephrolithiasis patients as compared to normal healthy controls (Table No. 6, Figure No. 2-c).

It has been reported by Shewilie et al., (1999) and Bajel A. R. et al., (2002) that the magnesium deficiency may occur in hypertension, increases myocardial tissue calcium and deposition of calcium phosphate in myocardium and arterial wall. It also occur in the renal cortimedullary region. However, in our study, the patients suffering from above diseases during the time of selection of the subjects were excluded. Patients were examined for any other disease and the nephrolithiasis patients were only included in the study. Hence the low magnesium level might be due to nephrolithiasis.

Direct inhibitory effects of magnesium citrate and alkali on calcium oxalate crystallization have repeatedly been reported by Pak C. Y. C. et al., (1992) and Li M. K. et al., (1988) and only one report has focused on the effect of magnesium in nephrolitiasis by Hallson P. C. et al., (1982).

In the present study, inverse relationship between calcium and magnesium levels has been observed. Normally magnesium is complexed
with calcium as well as oxalate and decreases their excretion in the urine. In the nephrolithiasis patients decrease urinary magnesium may increases the excretion of urinary calcium and oxalate, as sufficient amount of magnesium is not available to form the magnesium oxalate and calcium complex. The previous study showed that urinary magnesium excretion was higher in children than adult, hence incidence of nephrolithiasis in children is very low as compared with the adults in developed western countries (Omiyak et al., 1998; Churchill D. N. et al., 1980).

Generally the magnesium is able to increase the metastable limit of calcium oxalate solubility (Tolerable oxalate (TO)) to some extent in presence of practically unchanged supersaturation and directly inhibits calcium oxalate crystallization. This said mechanism would have been hampared in the nephrolithiasis patients, because of low excretion of magnesium in the urine. This indicates that there should be balance between excretions of divalent cations, thus balance might have been disturbed in nephrololithiasis patients.

Magnesium act as a crystal growth site poison or magnesium apart from their presence in hydration shell may enter the lattice of nascent calcium - oxalate crystals, thereby disturbing crystallization kinetics, and hence inhibits the stone formation.

Previous workers Desmars J. F. et al., (1973); McConnell N. (2002) had also reported the significant decreased urinary magnesium in nephrolithiasis patients as compared to controls.
6.2.5 Urinary calcium and inorganic phosphorus :-

It is generally considered that there is no one etiological factors responsible for the formation of renal calculi. However, the diet is one of the factor which influence the levels of various minerals such as calcium, sodium, potassium, and phosphorus etc. in the body.

In the present study significantly increased levels of urinary calcium (P < 0.001) were observed in nephrolithiasis patients than the normal healthy controls (Table No. 6 and Figure No. 2-a).

There could be several possibilities of increased urinary calcium levels in the nephrolithiasis patients.

The first possibility is that, there could be high intake of animal protein and salt by nephrolithiasis patients, which increases intestinal calcium absorption and thus increases urinary calcium excretion.

The second possibility is that the source of drinking water is hard water which is an important risk factor for stone formation. In the present study it has been observed that most of the people from Marathwada region uses Bore-well water for drinking purpose. Thus it may causes the hypercalciuria in nephrolithiasis patients.

The third possibility is the climatic condition, the present study was carried out in a geographical region having hot climate. Due to exposure
to sunlight, which enhances Vitamin 'D' synthesis results in increase intestinal absorption of calcium and thereby increased in calcium excretion in urine.

The fourth possibility is that, increase urinary sodium excretion caused increased urinary calcium excretion through renal mechanisms and increases mobilization of calcium from bones (P. Arivar F. et al., 1996). In the present study urinary sodium excretion were elevated in nephrolithiasis patients, hence calcium excretion may be increased. The urine get supersaturated with calcium and complexed with oxalate and forms seed crystals, increased in activity product and begins solid phase, lastly crystal grows in size (upper limit of metastability).

Our results of increased urinary calcium levles in nephrolithiasis were comparable with other workers (Evans R. A. et al., 1967; Coe F. L. and Kavalach A. G., 1974; Abdel-Aziz A Fetal 1996; R. Kumar et al., 2003).

In the present study urinary inorganic phosphorus levels were significantly decreased (P < 0.001) in nephrolithiasis patients as compared to normal healthy controls (Table No. 6 and Figure No. 2-c).

This decreased urinary phosphorus level in nephrolithiasis patients indicates the inverse relationship between calcium and phosphorous.

There are several possibilities for reduced urinary inorganic phosphorus. It may be due to low phosphorus in diet but this possibility is ruled
out as in the present study high levels of serum inorganic phosphorus was found in nephrolithiasis patients. Secondly it may be due to decreased glomerular filtration rate. In response to hyperphosphatemia, increase in urinary phosphorus excretion, thus in present study this mechanism does not work in nephrolithiasis patients as phosphorus excretion was decreased. (Flowchart No. 5).

Flow Chart No. 5: Increased Urinary Phosphorus excretion in response to hyperphosphatemia (normal mechanism).

The pyrophosphate inhibits the crystal growth in urine of brushite, but not cal-oxalate monohydrate. Thus the low level of phosphorus may be supported for stone formation. Nayer et al., (1997) reported no significance change in urinary inorganic excretion in nephrolithiasis patients and control group.
6.2.6 Urinary urea and creatinine:

Urea and creatinine are the non-protein nitrogenous substances. Urea is the main end product of protein metabolism. Urea excretion is influenced by dietary protein intake, it is filtered by the glomerulus and partially reabsorbed by renal tubules.

In the present study urinary urea levels were non significant (P > 0.05) when compared with normal healthy controls (Table No. 5). Thus in nephrolithiasis patients the urea concentration is not affected.

The creatinine is formed from creatine metabolism. Daily about 2% of the total creatine is converted to creatinine. The amount of creatinine produced is related to the total muscle mass and remains approximately the same in plasma and in urine from day to day unless the muscle mass changes.

In the present study the urinary creatinine levels were significantly decreased (P < 0.05) in nephrolithiasis patients as compared to normal healthy controls (Table No. 5 and Figure No. 1). The decreased urinary creatinine levels may be due obstruction in the flow of urine due to presence of renal calucli in the urinary tract, serum creatinine levels show no significant change in nephrolithiasis patients. This indicates that there is partial obstruction in the renal flow. Takashi Yagisawa et al., (2000); Loris Borgi et al., (1996); Michael J. Nicar et al., (1983); reported lower excretion of urinary creatinine in nephrolithiasis patients.
R. Kumar et al., (2003) reported no change in urinary creatinine excretion in nephrolithiasis patients.

6.2.7 Urinary Sodium, Potassium and Chlorides:

In the present study urinary sodium levels were significantly elevated (P < 0.001), whereas urinary potassium and chloride levels were significantly decreased (P < 0.05) and (P < 0.001) respectively in nephrolithiasis patients as compared to normal healthy controls (Table No. 6 and Figure No. 2-b).

The significant elevated levels of urinary sodium in nephrolithiasis patients may be due to high dietary intake of sodium, animal proteins and processed food stuffs (Flowchart No. 6)

Flow Chart No. 6: Increased urinary Sodium excretion in response to increased NaCl intake
also reported significantly elevated levels of urinary sodium in nephrolithiasis patients.

The significant decreased levels of urinary potassium and chloride in nephrolithiasis patients indicates that increased sodium excretion in nephrolithiasis patients is compensated with decreased urinary potassium and chloride levels to maintain normal electrolyte balance.

6.3 Urine analysis, microscopy, culture sensitivity:-

a) Specific gravity :-

In the present study the specific gravity ranges within the normal limits in the nephrolithiasis patients and normal healthy controls. The specific gravity of urine depends on total solids. This indicates that in nephrolithiasis patients specific gravity were not affected. It may be due to total solid concentration, excretion may be similar in nephrolithiasis patients and controls.

b) Urinary Volume :-

Urine factors that leads to idiopathic calcium nephrolithiasis and recurrences, include a low urine volume (Liungull S. and Danelsson B. G., 1984). The practice of increasing the urine volume with a high supply of water to prevent recurrences has been in use since the time of Hippocrates.
In the present study the low excretion of urine was shown in nephrolithiasis patients when compared with controls. This lower excretion is due to low intake of fluid and hot climatic condition. Decrease excretion of urine causes saturation of some of the salt that forms renal calculi. Thus high intake of water/fluid may reduce the supersaturation of urine. However, this protective effect of high water/fluid intake may be counterbalanced by an increased dissociation of soluble complexes of lithogenous salts and by the simultaneous decrease of the concentration of the inhibitors of calcium crystallization.

Pak et al., (1980) showed that the sufficient intake of water to bring the urine volume 2.5 L a day, reduced the tendency to calcium crystallization by lowering urine saturation of calcium oxalate and brushite and by increasing the limit metastability of calcium oxalate.

Many authors have shown that patients exposed chronic dehydration caused by a hot climate, working, sport activities performed at high temperatures and with abundant perspiration or scarce intake of liquids have particularly high incidence of nephrolithiasis (Parry E. S. and Lister I. S., 1975; Ferrie B. G. and Slott R., 1984; Embon et al., 1990; Borgh L. et al., 1993).

Thus the intake of adequate fluid is important factor to prevent stone formation (Flowchart No. 7).

Normaly kidney conserve water and excretes the solutes having low solubility and these two mechanisms are balanced during adaptation
of diet, climate and activity. When urine become supersaturated with solutes, as a result kidney excrete more water proportionately. But in nephrolithiasis water conservation may be extreme and hence crystals forms and may grow. The delicate balance between water conservation and excretion of solutes may be hampered in nephrolithiasis patients.

c) Urinary pH

The pH of urine in nephrolithiasis patients was significantly decreased as compared to healthy controls (Table No.7). As pH of urine in nephrolithiasis patient was not highly acidic hence the possibility of uric acid stone is ruled out. There is possibility of calcium oxalate stones, which was confirmed by urine microscopy. In urine on microscopy envelope shaped crystals were observed. Types of crystals depends on pH of urine thus the detection of pH of urine has got more importance in nephrolithiasis patients.

Uric acid crystals are found in acidic urine where as Triple phosphate crystals in neutral or alkaline urine (Langley S.E. and Fry C.H., 1997). In the present study the pH of urine in nephrolithiasis patient was lower than the control which is favorable for the calcium oxalate crystallization.

The lower pH of urine in nephrolithiasis patient is itself responsible for calciuim oxalate crystallization. In our present study the citrate concentration in urine of nephrolithiasis patients were reduced than that of the control group thus it indicates that the intratublar citrate protonation depends in

104
ambient pH, the low pH may drives the reabsorption of protonated citrate and this free citrate may cause excess of free calcium, hence the calcium ligniad gap which may constitute a crystallization.

The culture and sensitivity of urine was sterile. This indicates that infective stones was not present.

Negative Hematuria were observed in nephrolithiasis patient. Press SM, Smith AD they found a 14.5% incidence of negative Hematuria in patient with Acute urolithiasis.

6.4 Renal Stone analysis :-

The renal stone analysis were performed by standard methods. The stone analysis reveals that 78% of calcium oxalate, 20% of calcium oxalate with phosphate and 01% of calcium oxalate with uric acid nucleus. This indicates that in Marathwada region the prevalence of pure calcium oxalate stones are more.